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Dear Reader,

We take great pleasure in welcoming you to Issue 3 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: specimen tracking and One Health investigations during an anthrax outbreak in Kazo District; laboratory quality management performance of human and veterinary laboratories during an anthrax investigation in Kanungu District; a recurrent anthrax outbreak linked to consumption of meat from suddenly dead livestock in Kanungu District; chronic painful lower-limb ulcers of unknown etiology in Rubirizi District; a 7-1-7 assessment of delayed detection and response during a measles outbreak in Kyegegwa District; behavioral and social drivers of measles-rubella vaccine uptake in Kyegegwa District; measles-rubella zero-dose status during the Kyegegwa measles outbreak; healthcare-seeking behaviour among caregivers of children with suspected measles in Kyegegwa District; a multi-platform laboratory investigation of a disease of unknown aetiology in Rubirizi District; laboratory data utilisation at the KCCA Regional Public Health Emergency Operations Centre during the Bundibugyo Ebola outbreak; prolonged laboratory result turnaround time during a suspected food poisoning outbreak in Nakaseke District; completeness of patient status reporting in the Integrated Results Reporting and Data System during the Bundibugyo Ebola outbreak; an antibiogram to strengthen antimicrobial stewardship at General Military Hospital-Bombo; changing patterns of drug-resistant tuberculosis notifications; malaria diagnostic utilization across health facility levels; trends and distribution of zoonotic disease-related mortality; the effect of digital viral load requests on viral load turnaround time in Rwenzori Region; discrepancies between routine TB/HIV mortality reporting and medically certified causes of death; medical certification of cause of death for malnutrition mortality surveillance alongside DHIS2; and upcoming health events for October–December 2026.

Should you have any questions or require additional information related to articles in this bulletin please contact us on: wnakaweesi@uniph.go.ug, aamandu@uniph.go.ug, masabanamisi@uniph.go.ug, i.ayaa@uniph.go.ug, lbulage@uniph.go.ug

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Inside this issue:

02 Specimen tracking during an anthrax outbreak, Kazo District

54 Developing an Antibiogram in Bombo M. Hospital

61 Resistant tuberculosis in Uganda

71 Zoonotic diseases related mortality

Continued from page 1

Strengthening Specimen Tracking and One Health Investigations During an Anthrax Outbreak in Kazo District, Uganda, March, 2026

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Summary

Background: Anthrax is zoonotic disease that requires integrated human, animal, and environmental investigations, supported by effective specimen referral and documentation systems. Effective documentation supports coordination between human, animal and environmental health sectors, facilitates specimen tracking and case follow-up, provides timely information for public health decision-making and outbreak response. During the 2026 outbreak in Kazo District, the extent of specimen documentation across the referral pathway and the implementation of animal and environmental investigations alongside human case investigations had not been systematically assessed. We assessed specimen documentation throughout the testing and referral pathway and evaluated the integration of One Health investigations during the anthrax outbreak in Kazo District, Uganda

Methods: We assessed specimen documentation at Kazo Health Centre IV, Rwemikoma Health Centre III, and Kazo Veterinary Laboratory by reviewing laboratory and referral records for documentation of specimen collection, referral, testing, and receipt of results. Five Key informant interviews were conducted with One Health stakeholders to identify barriers to animal and environmental investigations. The One Health stakeholders were purposively selected including veterinary officer, crop and animal husbandry officer, veterinary and human laboratory technician and environmental officer. The interview transcripts were coded line-by-line with coding independently reviewed by two co-authors for consistency. Findings informed corrective actions, including strengthening specimen documentation and initiating animal and environmental sample collection and testing.

Results: Documentation of specimen collection, referral, testing, and receipt of results was absent for 20 specimens reviewed at Kazo Health Centre IV and Rwemikoma Health Centre III. No animal or environmental investigations had been conducted alongside laboratory-confirmed human anthrax cases. Interviews identified poor reporting of sick animals by farmers, limited anthrax awareness, inadequate laboratory capacity, and weak coordination among human, animal, and environmental sectors

Conclusion: Following the assessment, we customized a laboratory referral register to document all referred specimens and their corresponding test results. We also initiated animal and environmental sample collection to support anthrax investigations.

Background

Anthrax is a zoonotic disease caused by the spore-producing Gram-positive rod-shaped bacterium *Bacillus anthracis* (1). Anthrax is one of the priority zoonotic diseases in Uganda with the cattle corridors having frequent outbreaks that pose severe public health and economic risks. Anthrax primarily affects herbivorous animals, but also infects humans through direct or indirect contact with infected animals or their products (1).

Kazo District has experienced recurrent anthrax outbreaks. In late 2024, 22 human cases, including three deaths, were reported alongside hundreds of suspected animal deaths. Between January and February 2026, 25 human specimens were tested for anthrax, of which 16 (64%) were positive. Effective specimen management during outbreak investigations requires complete documentation throughout the testing pathway, including specimen identification and type, date and time of collection, referral details, receipt at the testing laboratory, and test results.

Continues to page 3

Continued from page 2

. Incomplete documentation and weak referral systems can compromise specimen traceability, delay testing and result communication, and limit the ability to construct the laboratory response. Assessment of specimen documentation is therefore important for identifying weaknesses that may affect the quality, timeliness, and continuity of diagnostic services during an outbreak (2).

Because anthrax is a zoonotic disease, outbreak investigations also require coordination across human, animal, and environmental health sectors. Following identification of a laboratory-confirmed human case, investigations may need to assess potential animal exposures, animal illness or deaths, and relevant environmental sources or conditions. Such coordinated investigations can help identify possible sources of exposure and inform control measures (3).

During the 2026 outbreak in Kazo District, the extent of specimen documentation across the referral pathway and the implementation of animal and environmental investigations alongside human case investigations had not been systematically assessed. We therefore assessed specimen documentation and referral practices and the application of the One Health approach during the anthrax outbreak and implemented corrective actions to address identified gaps.

Methods

The assessment was conducted in March, 2026 in Kazo District. The district health system comprises of one Health Centre IV, 10 Health Centre IIIs, and 10 Health Centre IIs. Laboratory services are available at Health Centre III level and Health Centre IV. For anthrax investigations, specimens are collected and transported through the national specimen referral and transport system to designated national reference laboratories for testing. Human specimens are referred for testing through the National Health Laboratory and Diagnostic Services, while animal and environmental specimens are referred to the National Animal Disease Diagnostics and Epidemiology Centre.

We purposively selected three laboratories including Kazo Health Centre IV, the district laboratory hub, Rwemikoma Health Centre III, a high-volume sample collection facility and Kazo Veterinary Laboratory, the district's only veterinary health laboratory. We conducted an assessment at Kazo Health Centre IV, Rwemikoma Health Centre III, and Kazo Veterinary Laboratory using a World Health Organization (WHO) laboratory assessment tool 2012 together with the National Laboratory Guidelines for Preparedness and Response to Public Health Emergencies 2023. Laboratory records and referral documentation were reviewed to assess documentation of specimens collected, referred, tested, and results received throughout the testing and referral pathway.

Five Key informant interviews were conducted with a purposively selected veterinary (01) and human laboratory technician (01), veterinary, crop and animal husbandry and environmental officers. The interviews were conducted to explore the implementation of animal and environmental investigations, intersectoral coordination, and barriers affecting one Anthrax health investigation. The interviews also assessed whether animal and environmental investigations were conducted alongside investigations of laboratory-confirmed human anthrax cases. Interview transcripts were coded line by line with coding independently reviewed by two co-authors to ensure consistency. Findings informed corrective actions, including strengthening specimen documentation and initiating animal and environmental sample collection and testing.

This investigation was part of a public health emergency response and was therefore determined to be non-research. The Ministry of Health (MoH) gave permission to conduct the investigation. This activity was reviewed by the US CDC and was conducted consistent with applicable federal law and CDC policy. §§See, e.g., 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq. Informed verbal consent was obtained from all participants. All investigation results were securely stored by the investigation team in locked cabinets and password-protected computers to ensure participants confidentiality.

Continues to page 4

Continued from page 3

Results

Specimen documentation and referral practices at Kazo Health Centre IV, Rwemikoma Health Centre III, and Kazo Veterinary Laboratory, Kazo District, March, 2026

The assessment revealed that of the 20 specimens reviewed at both Kazo Health Centre IV and Rwemikoma Health Centre III. There was no documentation of specimen collection, referral, testing, and receipt of results. The online sample tracking system lacked anthrax in its dropdown menu, limiting electronic tracking of suspected cases.
The veterinary laboratory maintained documentation of sample collection and result reporting for the previous anthrax outbreaks but had not documented any samples in the current 2026 outbreak. Sample referral mechanisms were in place and functional, and all assessed facilities complied with triple packaging requirements for specimen transport.

One Health application in anthrax investigation, Kazo District, March 2026

No animal or environmental investigations had been conducted alongside laboratory-confirmed human anthrax cases. We identified facilitators of and barriers to One Health application in anthrax investigation. Facilitators included availability of staff across the sectors, "*We have staff in the different sectors, and when there is a suspected anthrax case, we are able to work together"* —KII01.

Another facilitator included, "*We have an established One Health platform which provides a structure for bringing together the three sectors during an outbreak response. Although the platform is not currently active but its existence provides a foundation for joint response when needed"*—KII02.

Barriers to the One Health approach included difficulty obtaining investigation reports and animal and environmental samples, *"Sometimes farmers do not report sick or dead animals because they are afraid of losing money. They prefer to sell the animal cheaply rather than report it to the authorities"* —KII03.

Another barrier was similarity of anthrax signs to those of other diseases, limited awareness among farmers of how to identify sick animals promptly, *"In other cases, the farmers do not know what caused the animal to die, so they may not see the need to report it. This makes it difficult for us to get timely reports and samples for investigation"* —KII03.

The other barrier was absence of rapid diagnostic kits for anthrax testing, *"We currently do not have rapid diagnostic kits for anthrax. The last time we had them was in 2018, when they were provided as part of a study"*—KII04

Absence of environmental investigation, *"The last time we conducted environmental sampling was about five years ago, when the water was visibly discoloured and we collected water samples for investigation. Since then, we have not collected any soil or water samples for investigation"* —KII05

Discussion

There was no documentation of specimen collection, referral, testing, and receipt of results and animal or environmental investigations had not been conducted alongside laboratory-confirmed human anthrax cases. Weak documentation may compromise continuity along the testing pathway and limit timely linkage of laboratory findings to public health action. Strengthening standardized specimen tracking and result-feedback mechanisms could therefore improve accountability and coordination across the referral pathway (3).
The findings of no animal or environmental investigations being conducted alongside laboratory-confirmed human anthrax cases despite the presence of personnel from multiple sectors and an established One Health platform indicate the need for a more functional and routinely activated One Health response. Strengthening collaboration among human, animal, and environmental health teams, including engagement of farmers and private veterinary practitioners, could improve early detection, investigation, and control of future anthrax outbreaks (4).

Study limitation: The assessment was conducted at three purposively selected laboratories and may therefore not reflect specimen documentation practices across all facilities handling anthrax specimens in Kazo District. This was mitigated by selecting the high-volume facilities with key roles in the anthrax response. Findings from the key informant interviews may have been influenced by participants' recall and perceptions when describing barriers to animal and environmental investigations and intersectoral coordination.

Continues to page 5

Continued from page 4

To mitigate this, we included key informants from, human, animal, and environmental sectors and triangulated interview findings with available laboratory and referral records.

Conclusion: Assessment findings revealed deficiencies in specimen tracking and One Health coordination. Implementation of corrective actions strengthened documentation practices and enhanced integration of human, animal, and environmental sectors during anthrax outbreak investigations.

Public health actions: The District Laboratory Focal Person (DLFP) and laboratory staff were mentored on proper documentation of samples collected, samples referred, and results returned. A sample referral register was jointly designed to facilitate sample tracking of the referred samples. We supported DLFP to engage the Result Dispatch System (RDS) developers to include anthrax in the online sample tracking system to improve electronic tracking of suspected anthrax cases.

Specimens, including skin lesion swabs from 20 suspected human cases and blood samples from 10 affected cattle, surface soil and water from affected farms were collected following standard biosafety procedures. *Bacillus anthracis* was detected in 14 (70%) human and 6 (60%) animal samples, while all soil and water samples tested negative.

Continuous mentorship and support supervision across the human, animal, and environmental health sectors could sustain the One Health response.

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

Author contribution: CM led the study conceptualization, data collection, analysis, and article drafting. FMN, AA, IS, HK, BD, AN, WN, SN, NN, IA SNN, JK contributed to data collection and writing. SG, GE provided supervision and article review. All authors read and approved the final article.

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Continues to page 6

Continued from page 5

Comparative performance of human and veterinary laboratories in selected laboratory quality management system indicators during an anthrax investigation, Kanungu District, Uganda, March 2026

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Summary

Background: Laboratories play a key role in disease diagnosis, surveillance, outbreak detection, and public health response. Laboratory quality management systems (LQMS) are essential for quality laboratory services, importantly within the One Health framework for zoonotic disease detection and response. During investigation of a suspected anthrax outbreak in Kanungu District, Uganda, we conducted a comparative assessment of selected LQMS domains in human and veterinary laboratories to identify strengths and opportunities for strengthening integrated laboratory systems.

Methods: The assessment was conducted in March 2026 in Kanungu District, southwestern Uganda. Three laboratories were purposively selected: Kambuga hospital laboratory, Kanungu health centre IV laboratory, and Kanungu district veterinary laboratory. Using the World Health Organization standardized laboratory quality assessment tool, the three laboratory managers were assessed by two laboratory specialists across five LQMS domains, with laboratory managers as respondents: documented procedures, specimen management, laboratory request and result return systems, reagents and consumables management, and bio-risk management. Descriptive analysis was performed and results summarized as percentages.

Results: Kambuga hospital achieved the highest overall performance across assessed domains, scoring 100% for documented procedures and laboratory request/result return systems, 96% for specimen management, 80% for reagents and consumables management, and 70% for bio-risk management. Kanungu health centre IV demonstrated moderate performance, with scores ranging from 50% to 95%. The Kanungu veterinary laboratory recorded the lowest scores across all assessed domains, including documented procedures (42%), specimen management (47%), laboratory request and result return (27%), reagents and consumables management (31%), and bio-risk management (38%). Differences were seen between human and veterinary laboratory quality system implementation across all five domains.

Conclusion: We highlight stronger implementation of laboratory quality management systems in human health laboratories compared to the assessed veterinary laboratory. The findings identify gaps in veterinary laboratory quality systems at the subnational level and suggest that targeted technical assistance in quality improvement could be of value.

Introduction

Laboratories are fundamental to disease diagnosis, surveillance, outbreak detection, and public health decision-making (1). Reliable laboratory services depend on well-established laboratory quality management systems (LQMS) that promote consistency, accuracy, traceability, biosafety, and continuous quality improvement (2).

The increasing recognition of the interconnectedness of human, animal, and environmental health has strengthened emphasis on the One Health approach (3). Effective implementation of One Health requires functional laboratory systems across both human and animal health sectors to support timely detection and investigation of zoonotic diseases such as anthrax, rabies, brucellosis, Ebola virus disease, Rift Valley fever, and avian influenza

Uganda has strengthened laboratory quality systems in the human health sector through implementation of national laboratory quality-improvement and accreditation programmes (5). However, information on the implementation of comparable quality-management systems in subnational veterinary laboratories remains limited. Understanding the quality-system capacity of both sectors is important for identifying gaps that may affect coordinated detection and response to zoonotic disease threats.

Continues to page 7

Continued from page 6

On March 5, 2026, the Uganda Ministry of Health deployed a national rapid response team, including two laboratory specialists, to investigate a suspected anthrax outbreak in Kanungu District following reports of suspected anthrax deaths among cattle and suspected human cases. During the response, we assessed and compared selected laboratory quality management system indicators in human and veterinary laboratories in Kanungu District to identify strengths and opportunities for strengthening integrated laboratory systems.

Methods

The assessment was conducted in Kanungu District in southwestern Uganda, approximately 427 km from Kampala. Livestock keeping is a key economic activity in the district. Kanungu hosts Bwindi Impenetrable national park and is located near Queen Elizabeth national park and Virunga national park in the neighbouring Democratic Republic of the Congo.

The district health system comprises two general hospitals, four Health Centre IVs, 19 Health Centre IIIs, and 41 Health Centre IIs, with laboratory services available at Health Centre III level and above. The district veterinary system has one laboratory operated by one laboratory technician, providing limited serological testing for brucellosis and foot and mouth disease. More than 80% of samples from animals are referred to the National Animal Disease Diagnostics and Epidemiology Centre (NADDEC). During anthrax investigations, human specimens are referred through the National Health Laboratory and Diagnostic Services, while animal and environmental specimens are transported through the national specimen referral system to NADDEC and other designated national reference laboratories.

Three laboratories were purposively selected to represent key functions in the district anthrax response. Kambuga General Hospital Laboratory was selected because it managed confirmed human anthrax cases, had the highest attendance among assessed facilities, and was accredited to ISO 15189. Kanungu Health Centre IV Laboratory was selected because it served as the district laboratory hub and specimen referral point for transportation to national reference laboratories. Kanungu District Veterinary Laboratory was selected because it was the only animal-health laboratory in the district.

A standardized World Health Organization laboratory quality assessment tool was used to assess the three laboratories, comprising two human-health laboratories and one veterinary laboratory. Laboratory managers participated in the assessment, and available records and laboratory practices were reviewed. Five laboratory quality management system domains were assessed: documented procedures, specimen management, laboratory requests and return of results, reagents and consumables management, and biorisk management.

Assessment findings were descriptively analyzed and summarized by laboratory and quality management system domain as percentages. Each assessment item was scored as 1 for full implementation/compliance, 0.5 for partial implementation, and 0 for non-implementation/non-compliance. Items that were not applicable or had no score were excluded from calculations. Domain scores were calculated as the mean of valid item scores, including the applicable means of sub-domains or related item groups. Scores ranged from 0 to 1 and were expressed as percentages where appropriate. Overall laboratory performance was calculated as the arithmetic mean of all assessed domain scores, giving equal weight to each domain regardless of the number of items assessed. Domains without valid scores were excluded.

The 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 Uganda Ministry of Health and reviewed by the US CDC in accordance with applicable federal laws, CDC policy, and the Declaration of Helsinki. Permission was obtained from the district health officer and district veterinary officer, and verbal consent was obtained from laboratory managers because the information collected was considered minimally sensitive.

Results

Performance of assessed laboratories across laboratory quality management and biosafety domains in Kanungu District, Uganda

Kambuga Hospital scored highest across all domains: documented procedures (100%), laboratory requests and result return (100%), specimen management (96%), reagents and consumables management (80%), and bio-risk management (70%).

Continues to page 8

Continued from page 7

Kanungu HC IV scored 95% for laboratory requests and result return, 58% for documented procedures, 53% for specimen management, 58% for reagents and consumables management, and 50% for bio-risk management. Kanungu veterinary laboratory scored lowest across all domains: documented procedures (42%), specimen management (47%), laboratory requests and result return (27%), reagents and consumables management (31%), and bio-risk management (38%) (Table 1).

Table 1: Laboratory quality management system assessment scores in two human health laboratories and one veterinary laboratory, Kanungu District, Uganda, March 2026

Domains	Kambuga Hospital Hospital (%)	Kanungu HC IV Laboratory (%)	Kanungu veterinary laboratory (%)
Documented procedures	100	58	42
Specimen management	96	53	47
Laboratory requests and result	100	95	27
Reagents and consumables man-	80	58	31
Bio-risk management	70	50	38

Discussion

The assessment found differences between the laboratories in the implementation of quality management domains that are key to outbreak response. Kambuga Hospital performed best in implementation of laboratory quality systems. Kanungu HC IV performed second best, with Kanungu veterinary laboratory scoring least. The performance of Kambuga hospital laboratory showed a mature laboratory quality system, a reflection of strong investment in laboratory strengthening as the laboratory was internationally accredited. Kanungu Health Centre IV showed a moderate performance. While laboratory request and result management were well established, weaknesses in documentation, specimen management, inventory control, and biosafety showed opportunities for targeted quality improvement interventions.

Kanungu veterinary laboratory consistently scored lower across all assessed quality system domains. These findings suggest that veterinary laboratory quality management systems at the sub-national level may need to have similar levels of investment in quality systems technical assistance that has been evidenced in human health laboratory strengthening initiatives (8). Deficits in documented procedures can lead to inconsistent laboratory operations, and inadequate consumables management can increase the risk of stock-outs, wastage through expiry, and poor-quality testing. Inadequate bio-risk management can lead to ecological risks that are important when handling zoonotic pathogens (9).

An Armenian study reported baseline general indicator scores of 21%–46% among human laboratories and 37%–60% among veterinary laboratories, indicating substantial gaps in QMS implementation (9). Similarly, Kanungu veterinary laboratory showed generally weak performance across all domains, scoring 27%–47%, while the human health laboratories performed considerably better, particularly Kambuga Hospital (70%–100%) and Kanungu HC IV (50%–95%). These findings reinforce the observation that laboratory quality systems may vary considerably between human and veterinary sectors and highlight the need for a coordinated One Health approach to laboratory quality improvement.

The findings support the need to further strengthen veterinary laboratory systems within Uganda's One Health framework. Extending technical assistance programs such as quality system mentorship, quality improvement programs, biosafety training, standardized operating procedures development, and supportive supervision to veterinary laboratories would benefit preparedness for future public health emergencies (10).

Study limitations: This assessment involved only three laboratories and only selected quality management domains were selected, therefore the results may not be generalized to human and veterinary laboratories in other districts. Secondly, the assessment covered selected QMS domains consequently the findings provide partial assessment of quality management system implementation.

Continues to page 9

The domains not included are; equipment, human resources and testing performance. This is because these laboratories only referred samples to the national testing laboratories. Nevertheless, it provides useful baseline information on key quality management gaps and highlights essential areas that must be strengthened during a public health response. Larger studies involving multiple districts human and veterinary laboratories would provide more comprehensive comparative evidence to guide national laboratory strengthening strategies.

Conclusion: The comparative assessment between human health laboratories and the assessed veterinary laboratory showed relatively stronger laboratory quality management systems in the human health laboratories compared to the veterinary laboratory. The findings identify gaps in veterinary laboratory quality systems at the subnational level and suggest that targeted technical assistance in quality improvement could be of value.

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Conflict of interest: The authors declare no competing interests.

Authorship contributions: PP drafted the initial version of the manuscript. SG, MO revised the article for substantial intellectual content. PP, VN, DA, SN participated in the outbreak investigation. SG, MO also supervised the field activity.

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Continues to page 10

Continued from page 9

Recurrent anthrax outbreak linked to consumption of meat from suddenly dead livestock, Kanungu District, Uganda, 2025–2026

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Summary

Background: On November 3, 2025, a suspected case of anthrax presented at Kihihi Health Centre IV and was later confirmed by Polymerase Chain Reaction (PCR) at the Uganda Virus Research Institute (UVRI) on December 10, 2025. We investigated the outbreak to determine its magnitude, identify risk factors for human infection, and recommend control measures.

Methods: We defined a suspected cutaneous anthrax case as acute onset of skin lesions (papule, vesicle, or eschar) with ≥2 of itching, reddening, swelling, headache, fever, loss of appetite, or general body weakness in a Kanungu District resident from October 2025–March 2026. A suspected gastrointestinal anthrax case was acute-onset abdominal pain with ≥2 of vomiting, diarrhea, lymph node swelling, fever, body weakness, loss of appetite, or headache. A confirmed case was any suspected case with confirmed *Bacillus anthracis* by PCR. We identified cases through health facility record reviews, snowballing, and community searches. We conducted an unmatched case-control study to identify risk factors associated with the illness.

Results: We identified a total of 52 cases (42 suspected, 10 confirmed) with one death (CFR=2%). In total, 41 (79%) presented with cutaneous anthrax only, 3 (6%) gastrointestinal anthrax only, and 8 (15%) both cutaneous and gastrointestinal anthrax. The overall attack rate (AR) was 17/100,000. Males (AR: 28/100,000), persons aged ≥15 years (AR: 24/100,000), and Nyamirama Sub-county were most affected (AR: 86/100,000). Three of the five cattle samples tested and 10 of the 12 human samples were PCR-positive for *Bacillus anthracis*. Eating meat from livestock that died suddenly (aOR=6.4, 95% CI: 2.3–17) and male sex (aOR=5.1, 95% CI: 1.4–19) were associated with anthrax.

Conclusion: Kanungu District experienced a recurrent anthrax outbreak associated with consumption of meat from livestock that died suddenly. We recommend community education against consuming meat from sudden-death animals.

Introduction

Anthrax is an acute zoonotic disease caused by the Gram-positive, spore-forming bacterium *Bacillus anthracis*. The disease mainly affects herbivores such as cattle, sheep, and goats. Humans may become infected through direct or indirect contact with infected animals or contaminated animal products, consumption of under-cooked meat, inhalation of aerosolized spores or, less commonly, through injection of contaminated drugs [1].

The clinical presentation of anthrax varies by route of exposure, resulting in four distinct forms: cutaneous, gastrointestinal, inhalational, and injection anthrax. Each form has a characteristic incubation period and transmission pathway. Cutaneous anthrax, accounting for the majority of cases, typically develops within 1–12 days after spore introduction through skin abrasions. In contrast, gastrointestinal anthrax follows ingestion of contaminated meat and usually manifests within 2–5 days [2-4].

Anthrax is endemic in many African countries, with several outbreaks reported among domestic livestock, and human populations. Uganda has previously experienced numerous human outbreaks in western Uganda, in districts such as; Ibanda, Isingiro and Kiruhura. Kanungu District had its first ever human anthrax outbreak from June to November 2024, resulting in 75 cases and 5 deaths; human anthrax has been confirmed in Kanungu for a second time.

On November 3, 2025, a suspected case of anthrax presented at Kihihi HCIV and was later confirmed by PCR at the Uganda Virus Research Institute (UVRI) on December 10, 2025..

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We investigated the outbreak to determine its magnitude, identify risk factors for human infection, and recommend control measures.

Methods

We investigated an anthrax outbreak in Kanungu District, southwestern Uganda, from October 2025 to March 2026. In Kanungu District, the local economy is heavily dependent on subsistence agriculture, with most households engaged in mixed farming systems that combine crop production and livestock keeping.

We defined a suspected cutaneous human anthrax as acute onset of skin lesions (papule or vesicle or eschar) with ≥2 of skin itching, reddening, swelling, headache, fever, loss of appetite, or general body weakness; a suspected gastrointestinal human anthrax case as acute onset of abdominal pain with ≥2 of vomiting, diarrhea, swelling of lymph nodes, fever, general body weakness, loss of appetite, or headache; a confirmed human anthrax case as a suspected case with a positive test for *B. anthracis* by polymerase chain reaction (PCR) in a resident of Kanungu District from October 2025 to March 2026.

To find human cases, we reviewed medical records at health facilities, identifying all diagnoses consistent with anthrax; from October 2025 to March 2026. We found additional cases in the communities by active case search and we generated a line-list.

We described cases by person, place, and time. Using the 2024 projected population data for sub-counties, we computed attack rates by age, sex, and sub-county. We also constructed choropleth maps showing distribution of cases across sub-counties.

Twelve human and five animal clinical specimens including whole blood and swabs from skin lesions were collected from suspected cases following standard biosafety procedures [5]. Laboratory confirmation was conducted using PCR for *Bacillus anthracis.*

Environmental assessments and hypothesis-generating interviews were conducted in affected communities to explore livestock deaths, animal-handling practices, meat distribution, and potential human exposures. We then conducted an unmatched 1:4 case-control study to identify factors associated with human anthrax. Cases were individuals meeting the suspected and confirmed anthrax case definition. Controls were residents of the same sub-counties as cases who had not developed symptoms consistent with anthrax during the outbreak period.

Data were analyzed in Stata version 17. We summarized descriptive characteristics and estimated crude and adjusted odds ratios with 95% confidence intervals using logistic regression.

The investigation was conducted as part of the Ministry of Health public health response and was determined by CDC to be non-research. Informed consent was obtained from adult participants, with parental consent and assent obtained for minors.

Results

Descriptive epidemiology

We identified a total of 52 cases (42 suspected, 10 confirmed) with median age of 30 years (IQR: 20-45). Of 52, 38 (73%) were male, and 46 (88%) were aged ≥15 years. The overall attack rate (AR) was 17/100,000. Males were more affected (AR: 28/100,000) than females (AR:8/100,000). Persons aged ≥15 years (AR: 24/100,000) were the most affected age-group compared to those aged 10-14 years (AR: 8/100,000) and 0-9 years (AR: 4/100,000). Of the five animal samples collected, three tested positive for *Bacillus anthracis.* Of the 52 cases, 41 (79%) presented with cutaneous anthrax only, 3 (6%) with gastrointestinal anthrax only, and 8 (15%) with both cutaneous and gastrointestinal anthrax.

Cases occurred in the sub-counties of Kanungu District, with Nyamirama Sub-county recording the highest attack rate (86/100,000), followed by Nyakinoni Sub-county (79/100,000) (Figure 1).

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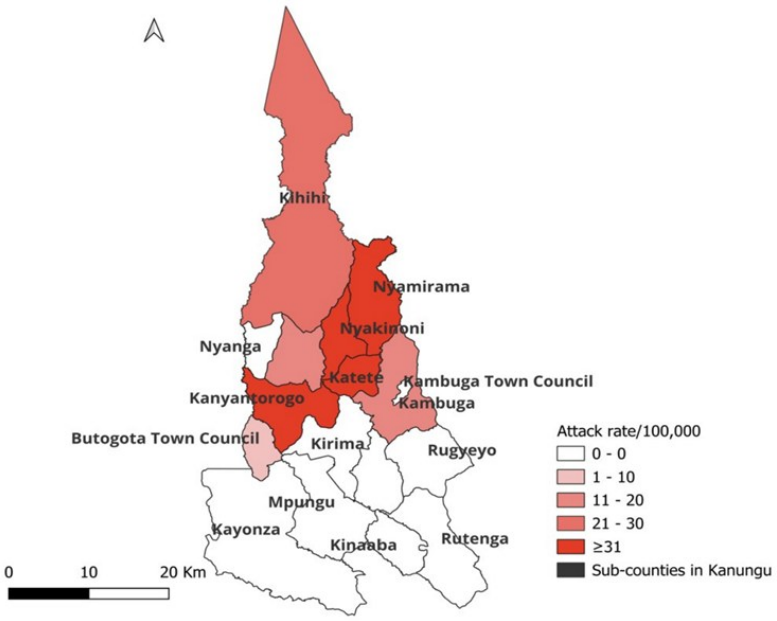


Figure 1: Attack rates of the affected sub-counties during an anthrax outbreak in Kanungu District, October 2025–March 2026

On October 23, 2025, a cow died suddenly in Katete Sub-county. On November 3, 2025, the index case presented to Kihihi HCIV. The outbreak peaked in mid-to-late November 2025. Laboratory confirmation of anthrax followed on December 10, 2025 (Figure 2). Animal deaths were followed by human cases.In response to the sudden animal deaths, a vaccination campaign began on November 24, 2025.
The National Rapid Response Team was deployed to the district on March 2, 2026 (Figure 2).

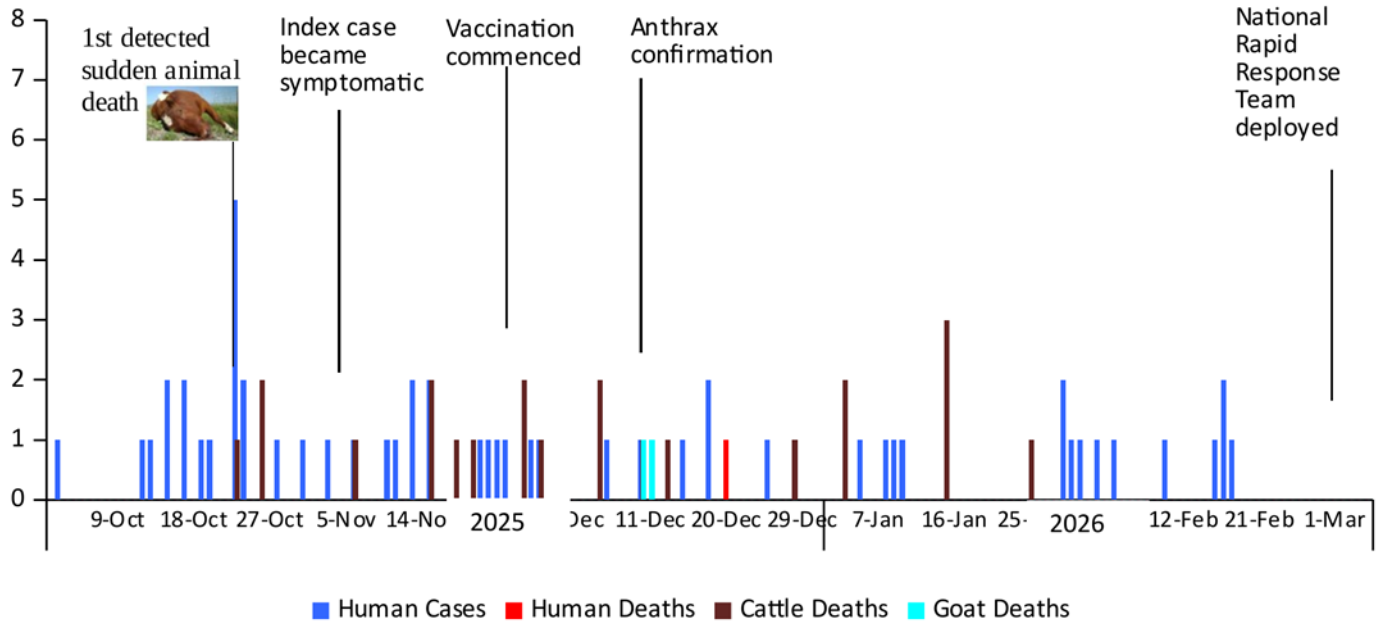


Figure 2: Distribution of cases by date of symptom onset and animals by date of death during an anthrax outbreak, Kanungu District, October 2025–March 2026 (n=52)

Hypothesis generation interview findings: We observed common exposures among 24 case-persons, of whom 75% had consumed meat from suddenly dead animals, 58% participated in trading or butchering cattle and 50% had carried butchered parts. With the results from descriptive analysis, we hypothesized consumption of meat from livestock that died suddenly drove the spread of anthrax.

Unmatched case-control study findings

At bivariate analysis, male sex, age ≥50 years, butchering of carcasses, meat dealer, cattle keeper, eating meat of livestock that died suddenly, skinning carcasses, and carrying butchered parts had p-values less than 0.2 and were taken into multivariate analysis (Table 1). At multivariate analysis, male sex

Continues to page 13

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(aOR=5.1, 95% CI: 1.4-19, p=0.010), and eating meat of livestock that died suddenly (aOR=6.4, 95% CI: 2.3–17, p<0.001) were significantly associated with anthrax.

Table 1: Bivariate analysis of risk factors for anthrax among cases and controls, Kanungu District, Uganda, October 2025–March 2026

Variable	Category	Cases n=24 n (%)	Controls n=96 n (%)	cOR (95% CI)
Sex	Male	21 (88)	53 (55)	5.7 (1.6-20)
	Female	3 (12)	43 (45)	Reference
Age group (years)	15-29	10 (41)	27 (28)	Reference
	30-49	11 (46)	32 (33)	0.93 (0.34–2.5)
	≥50	3 (13)	37 (39)	0.22 (0.05–0.87)
Meat dealer	Yes	5 (21)	8 (8)	2.9 (0.85–9.8)
	No	19 (79)	88 (92)	Reference
Cattle keeper	Yes	6 (25)	8 (8)	3.7 (1.1–11)
	No	18 (75)	88 (92)	Reference
Ate meat of livestock that died suddenly	Yes	17 (71)	25 (26)	6.9 (2.6–18)
	No	7 (29)	71 (74)	Reference
Carried butchered parts	Yes	4 (17)	5 (5)	3.6 (0.90–14)
	No	20 (83)	91 (95)	Reference
Skinned carcasses	Yes	7 (29)	12 (13)	2.9 (0.99–8.4)
	No	17 (71)	84 (87)	Reference
Butchered carcasses	Yes	11 (46)	10 (11)	7.2 (2.6–20)
	No	13 (54)	86 (89)	Reference

n-number of participants, cOR-crude odds ratio, CI-confidence interval

At multivariate analysis, male sex (aOR=5.1, 95% CI: 1.4-19, p=0.010), and eating meat of livestock that died suddenly (aOR=6.4, 95% CI: 2.3–17, p<0.001) were significantly associated with anthrax.

Discussion

Following the first-ever anthrax outbreak in Kanungu District from June–November 2024, a second outbreak occurred from October 2025–March 2026, which was linked to consumption of meat from livestock that died suddenly. Additionally, being male significantly increased the odds of illness.

Consumption of meat from animals that died suddenly increased the odds of being a case. Our finding aligns with findings from previous studies on anthrax in Uganda. A study in Kiruhura District found out that consumption of infected meat was associated with six-fold increased odds of getting anthrax [6].

Male sex increased the odds of case status by about fivefold compared with female sex. Males in pastoral communities disproportionately perform high-risk activities such as slaughtering, butchering, skinning, and carcass disposal. Similar sex disparities have been documented in other studies with males being more affected than females [6-8].Despite the implementation of livestock vaccination campaigns, enhanced surveillance, and community education following the 2024 outbreak, these measures proved insufficient to eliminate the conditions that continued to support anthrax transmission as they were not implemented beyond the outbreak period.

Study limitations: In this investigation, exposure information was self-reported and could not beindependently verified, introducing potential recall bias. However, the biological coherence of the findings and their consistency with previous Ugandan outbreak investigations reduce the likelihood that recall bias alone explains these results. In addition, the small number of cases limited statistical power for the multivariate analysis. We used a 1:4 case to control ratio to increase statistical power.

Conclusion: Kanungu District experienced a recurrent anthrax outbreak associated with consumption of meat from livestock that died suddenly.

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Nyamirama Sub-county was the most affected. We recommend community education against consuming meat from sudden-death animals.

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

Authors' contribution: All authors contributed to the write-up and review of the bulletin article. VJK drafted the initial version of the article. JW, PA, SN, DA, KDA, EM, AB, KMB participated in the data collection and case investigations and data analysis. RM, PE, and BK supervised the field data collection and reviewed the article for substantial intellectual content. All authors read and approved the final bulletin article.

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Investigation of chronic painful lower-limb ulcers of unknown etiology, Rubirizi District, Uganda, March–December 2025

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Summary

Background: In November 2025, Uganda's Ministry of Health received reports of community deaths linked to an unknown cutaneous ulcerative illness in Rubirizi District. We investigated to verify the event, describe epidemiology, assess etiologies, health seeking behavior and recommend control measures.

Methods: A suspected case was defined as onset of a painful papule or blister, limb swelling, and a non-healing ulcer lasting >4 weeks with at least one of the following symptoms: fever, general body weakness, headache, loss of appetite, vomiting or abdominal pain in a Rubirizi resident from March–December 2025. We reviewed facility records, verified household cases, conducted active case finding, and collected clinical, exposure, environmental, and health-seeking data. Blood, wound swabs,

Continues to page 15

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, and biopsies were tested by microscopy, serology, culture, PCR, histopathology, toxicology, and metagenomic sequencing. We conducted 12 key informant interviews on community perceptions and care-seeking.

Results: We identified 18 suspected cases, including 4 deaths (case fatality rate= 22%). Fourteen (78%) were male; median age was 43.5 years (interquartile range: 22–59.5). All had painful ulcers; 17 (94%) had unilateral limb swelling. Cases occurred sporadically, with late October–November clustering; no household had >1 case. Priority infectious, toxic, metabolic, and malignant causes were negative or non-diagnostic. Metagenomic sequencing detected *Mycobacteroides abscesses* and *Paraburkholderia fungorum* in two wound swabs, but no definitive etiology was established. Ten cases sought biomedical care, mostly from drug shops; none reported government-facility care. Qualitative findings suggested that delayed formal care-seeking was influenced by distrust of health facilities, fear of poor outcomes after facility attendance, uncertainty about the illness, financial and transport barriers, perceived medicine shortages, and reliance on herbal remedies.

Conclusions: This investigation identified a cluster of chronic painful lower-limb ulcers of undetermined etiology, without evidence of rapid person-to-person transmission. We recommended strengthened surveillance, community engagement, early referral, and advanced diagnostics to guide prevention and control.

Background

Chronic cutaneous ulcers are an important but often underrecognized cause of morbidity in low-resource settings, where delayed diagnosis and limited access to wound care can result in prolonged illness, disability, secondary infection, and death [1-3]. Their causes are diverse and include non-infectious conditions such as diabetes, vascular disease, malignancy, and trauma-related wounds, as well as infectious causes including Buruli ulcer, leishmaniasis, leprosy, lymphatic filariasis, mycetoma, yaws, anthrax, and atypical mycobacterial infections [3-7].

On 26 November 2025, Uganda's Ministry of Health received an alert about community deaths associated with an unknown illness in Kyabakara Subcounty, Rubirizi District. Initial reports described fluid-filled blisters on the lower limbs that progressed to non-healing ulcers; by 27 November, 13 suspected cases, including 4 deaths, had been reported. We investigated to verify the reported event, describe the epidemiology and clinical features of the cases, assess possible infectious, toxic, metabolic, malignant, environmental, and behavioral contributors, and recommend evidence-based measures for surveillance, case management, community engagement, and prevention.

Methods

Rubirizi District is predominantly rural, with most residents engaged in subsistence farming. The district has an estimated population of 167,527 people across two town councils and nine sub counties and part of Queen Elizabeth National Park is located within the district (Uganda Bureau of Statistics).

We conducted a field investigation to characterize the cluster of cases presenting with an unknown cutaneous ulcer in Rubirizi District, Western Uganda from March to December 2025. A suspected case was defined as onset of a painful papule or blister, limb(s) swelling and non-healing ulcer or ≥4 weeks with at least one of the following symptoms: fever, general body weakness, headache, loss of appetite, vomiting or abdominal pain in a resident of Rubirizi District between March–December 2025.

We reviewed health facility records and district line list, verified reported cases, and conducted active case finding. Suspected cases were interviewed using a standardized questionnaire to collect socio-demographic, clinical, health-seeking and exposure information. Key informant interviews (KII) were conducted with district health leaders, community leaders, traditional healers, cases and caregivers of deceased cases to explore perceptions of the illness, health-seeking behavior, access to health services, and potential environmental or socio-cultural risk factors.

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All identified case-patients were screened for diabetes mellitus. Blood specimens were collected from 10 case-patients and ulcer specimens were collected from 6 case-patients. Specimens were referred to national reference laboratories for testing for viral infections, toxicologic causes, microbiological, antimicrobial susceptibility and histopathological testing. Laboratory investigations included polymerase chain reaction (PCR), serology, microscopy, bacterial culture, and antimicrobial susceptibility testing. Cases were described by person (age, sex, clinical characteristics), place (village, parish, sub county), and time (date of symptom onset). An epidemic curve was constructed to describe the temporal distribution of cases.

The Ministry of Health, Uganda provided administrative clearance to conduct this investigation. Permission to conduct the investigation was obtained from Rubirizi District Health Office. In addition, we received a non-research determination clearance from the US Centers for Disease Prevention and Control (US CDC). This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy. § §See e.g., 45 C.F.R.part 46, 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq. All respondents gave individual verbal consent or assent for interviews. We conducted the interviews in privacy to ensure confidentiality and the data kept under password protection by the investigation team.

Results

Descriptive epidemiology of the chronic painful lower limb ulcer cases, Rubirizi District, Uganda, March–December 2025

We identified a total of 18 cases were including 4 deaths (case fatality rate = 22%). Of the 18 cases, 14 (78%) were male and 4 (22%) were female. The overall attack rate was 10/100,000 and the median age was 43.5 (1QR 22-59.5) years. All cases except one presented with unilateral swelling of the limb. All the identified cases had a wound/ulcer which were painful. Sporadic cases were identified at the parish level across five administrative units in Rubirizi District, Uganda (Figure 1).

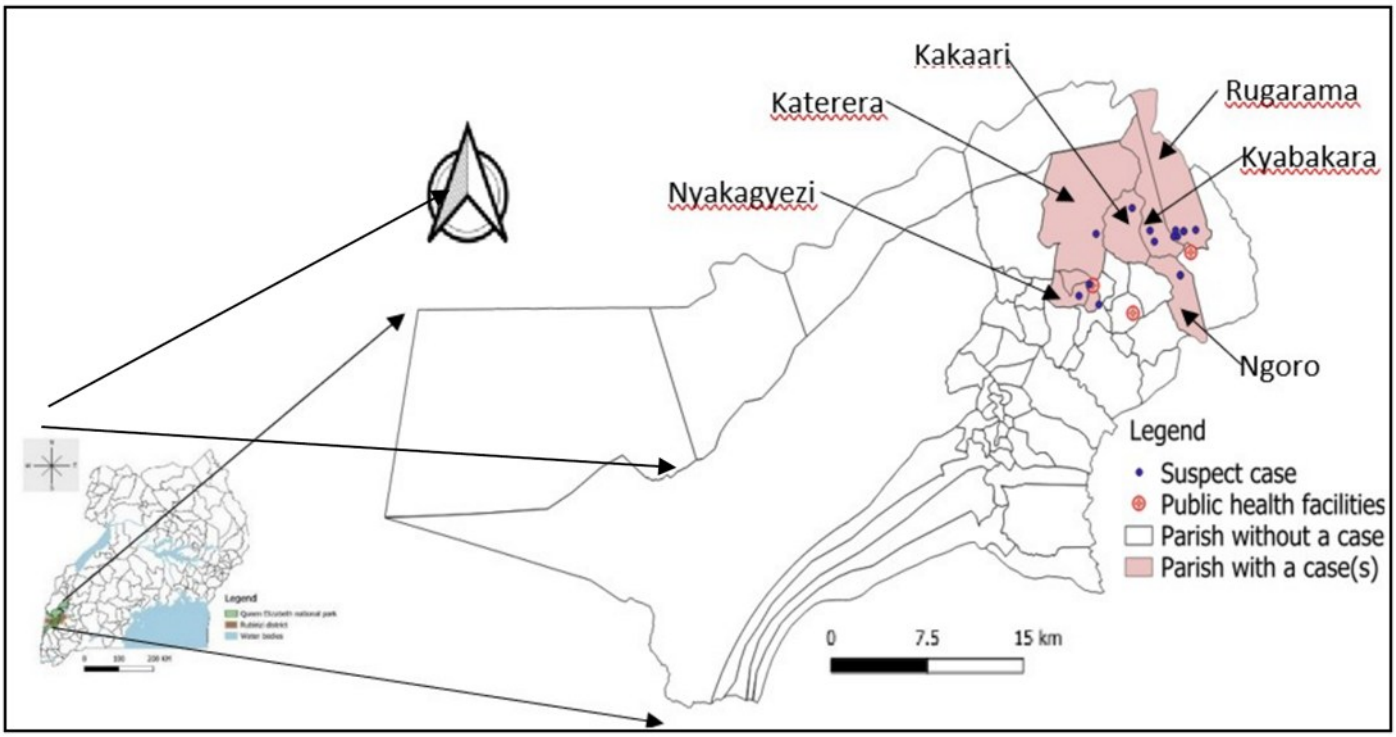


Figure 1: **Geographic distribution of suspected chronic painful lower-limb ulcer cases by parish, Rubirizi District, Uganda, March–December 2025**

The epicurve shows a sporadic pattern of cases occurring throughout the year, with isolated cases reported between March and December 2025 (figure 2). A marked increase began in late October (epidemiological week 44) and the last recorded date of onset was in December 2025.

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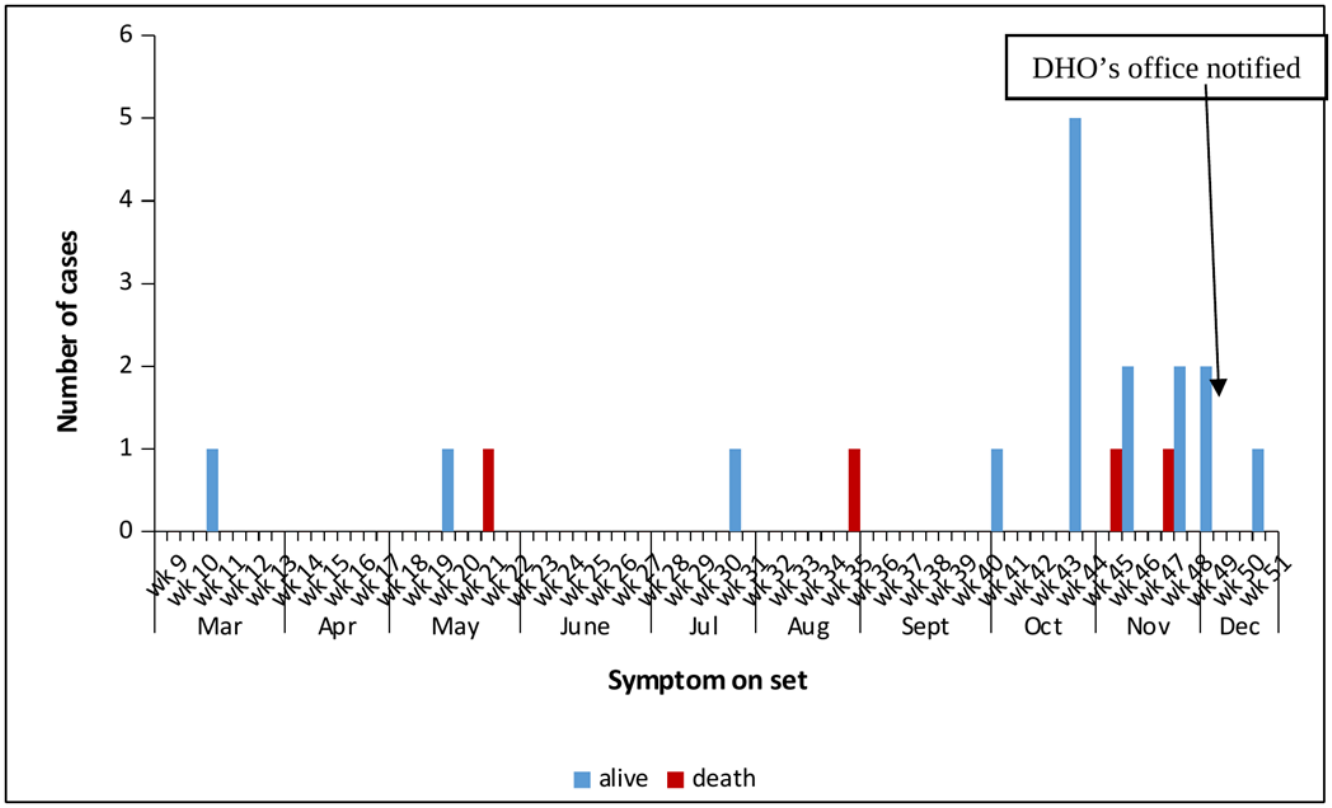


Figure 2: Distribution of chronic painful lower- limb ulcer cases, Rubirizi District, Uganda, March Uganda, March–December 2025 (n=18)

Environmental and laboratory assessment of chronic painful lower- limb ulcer cases, Rubirizi District, Uganda, March Uganda, March–December 2025

Case households generally had poor sanitation and hygiene, and no household had more than one case, providing no evidence of person-to-person transmission. No animal deaths were reported in the affected communities.

Laboratory investigations did not identify a definitive cause. Random blood glucose, complete blood count, and renal function tests results were within normal limits for all patients tested. Investigations for common infectious and non-infectious causes of chronic skin ulcers were largely unremarkable. Ziehl-Nelsen staining of ulcer specimens showed no acid-fast bacteria while filarial antigen testing was negative in all tested patients.

Serological testing identified one patient with a positive leishmaniasis antibody result. Histopathology examination of punch biopsy specimens showed no evidence of malignancy. Culture of wound swab yielded mixed Gram-negative and Gram-positive bacterial organisms. Antimicrobial susceptibility testing was performed to guide clinical management. Anthrax rapid diagnostic tests and PCR were also negative. Metagenomic sequencing identified *Mycobacteroides abscesses* in two samples. Heavy metals analysis of blood and soil detected iron only; aluminium, arsenic, cadmium, mercury, or lead were not detected.

Healthcare seeking and community perceptions of chronic painful lower- limb ulcer cases, Rubirizi District, Uganda March–December, 2025

Delayed healthcare seeking was common. Of 18 cases, 10 sought biomedical care, most initially obtaining treatment from drug shops, and none reported seeking care at a government health facility. Key informants described fear of death following hospital attendance, limited trust in formal health services, financial and transport constraints, perceived medicine shortages, and beliefs that the illness was caused by witchcraft as barriers to timely care. Herbal remedies were commonly used and were often applied directly to the ulcers.

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Discussion

This investigation identified 18 suspected cases of chronic painful lower-limb ulcers, 4 deaths, and did not establish a definitive etiology. Cases occurred sporadically across several parishes, with no household clustering or evidence of rapid person-to-person transmission. However, high case fatality, delayed formal care-seeking, and absence of a confirmed cause made the event an important public health signal.

The clinical syndrome helped narrow the differential diagnosis. Painful distal lower-limb ulcers with unilateral swelling differed from the classic early presentation of Buruli ulcer, which is often painless and commonly affects children in endemic settings [8, 9]. Testing reduced the likelihood of several infectious, toxic, metabolic and other causes. Metagenomic sequencing detected *Mycobacteroides abscesses* and *Paraburkholderia fungorum* in two wound specimens. M*ycobacteroides abscesses* is a rapidly growing, multidrug-resistant nontuberculous mycobacterium that is ubiquitous in soil and water [10]. These findings are hypothesis-generating rather than evidence of causation because organisms detected in chronic wounds may represent colonization, secondary infection or environmental contamination.

A major public health finding was limited formal care-seeking. Although 10 cases sought biomedical care, most obtained medicines from drug shops, and none reported seeking care from a government health facility. Interviews identified distrust, fear of poor outcomes after facility attendance, financial and transport barriers, perceived medicine shortages, and reliance on herbal remedies contributed to avoidance or delay in seeking formal care [11-13]. Strengthen surveillance and referral for unexplained or non-healing ulcers, standardize wound assessment and referral specimen referral, and engage communities, local leaders and traditional healers could support earlier identification and improve diagnosis and management.

Study limitations: The relatively small number of identified cases may limit the extent to which findings can be extrapolated to populations beyond the affected communities. To mitigate this, we conducted an exhaustive active case search through house-to-house visits in all affected villages, reviewed health facility records, and used snowball sampling to ensure we captured every identified case. We also triangulated quantitative findings with qualitative data from 12 key informants and laboratory results, strengthening internal validity.

Laboratory testing was incomplete: metagenomics was performed on only two samples, and confirmatory testing (culture, specific PCR) is pending. To mitigate this limitation, we prioritized sampling from patients with active, untreated ulcers to maximize pathogen yield. Samples were aliquoted and stored at −80°C to enable future testing. We also tested for a broad range of endemic pathogens (filaria, anthrax, Buruli ulcer, leishmaniasis, VHFs, toxicants) to rule out common causes. Results were interpreted cautiously, with clear distinction between preliminary and confirmed findings.

Conclusion: This investigation identified a cluster of chronic painful lower-limb ulcers of undetermined etiology in Rubirizi District. Although the pattern did not suggest rapid person-to-person transmission, the unexplained deaths and delayed formal care-seeking warranted a public health response. Strengthening surveillance, early referral, standardized wound care, community engagement and diagnostic capacity could improve management of similar presentations. Further multidisciplinary investigations integrating clinical, microbiological, pathological, environmental and molecular approaches are needed to determine the underlying cause and guide targeted prevention and control.

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Author contributions: DA took lead in conceptualizing the study idea, data collection, data analysis, bulletin article writing and editing.

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. MM, SN, MN, CM, AA were involved in the investigation, data collection, and bulletin writing. RM, BK, NA supervised the investigation, and reviewed the bulletin article. All the authors read and approved the final bulletin article.

Conflict of interest: The authors declare no competing interests.

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Delayed detection and response during a measles outbreak in Kyegegwa District, Uganda: findings from a 7-1-7 assessment, January–April 2026

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Summary

Background: Kyegegwa, a refugee-hosting district with recurrent measles outbreaks, experienced a measles outbreak in early 2026. We applied the 7-1-7 framework to assess the timeliness of outbreak detection, notification, and response, identify operational enablers and bottlenecks, and propose control measures to strengthen future outbreak preparedness.

Methods: We conducted a standardized 7-1-7 assessment using case investigation forms, surveillance line lists, and key informant interviews with district health team members and community informants. We measured three intervals: symptom onset to detection, detection to notification, and notification to completion of early response actions, and compared them with the 7-1-7 targets.

Results: The outbreak involved 85 measles cases (80 suspected, 5 laboratory-confirmed) and one death. The recognized outbreak cluster emerged on March 7, 2026, and was detected 8 days later, exceeding the ≤7-day detection target. Notification occurred on the day of detection, meeting the ≤1-day target. Early response actions were completed 10 days after notification, exceeding the ≤7-day target. Detection delays were attributed to weakened community-based surveillance after Village Health Team (VHT) restructuring, low clinical suspicion, case misclassification, delayed care seeking, and prolonged laboratory turnaround time. Response delays were linked to lack of contingency funding, delayed rapid response team (RRT) deployment, inconsistent partner support, and absence of a costed outbreak response plan. District leadership, Regional Emergency Operations Centre (EOC) support, and prior outbreak response experience facilitated implementation.

Conclusion: The district met the 7-1-7 notification target but missed the detection and early response targets. Strengthening community surveillance, frontline clinical recognition, laboratory turnaround time, contingency financing, and district preparedness planning could improve future outbreak response timeliness.

Background

Measles is a highly contagious vaccine-preventable disease that disproportionately affects young and immunologically vulnerable children. Outbreaks occur when vaccination coverage falls below the approximately 95% level required for population immunity, allowing susceptible children to accumulate. Despite routine immunization and supplementary campaigns, measles outbreaks and related deaths continue to occur (1,2).

Timely detection and response are critical to limiting transmission. The 7-1-7 framework assesses whether outbreaks are detected within seven days of emergence, notified within one day, and whether seven early response actions are completed within seven days of notification. Uganda adopted the framework in 2021 to identify surveillance and response bottlenecks and strengthen preparedness (3).

Kyegegwa District has experienced recurrent measles outbreaks and hosts a large refugee population, where crowding, malnutrition, and vaccination gaps may increase transmission risk (4). We assessed the timeliness of detection, notification, and response during the 2026 measles outbreak using the 7-1-7 framework, identified key enablers and bottlenecks, and proposed corrective actions.

Continues to page 21

Continued from page 20

Methods

We conducted the investigation in Kyegegwa District, western Uganda, which had an estimated population of 501,120 in 2024 and hosted 135,681 refugees. A suspected measles case was defined as acute fever and maculopapular rash with cough, coryza, or conjunctivitis among district residents during January–April 2026; confirmed cases tested positive for measles-specific IgM.

We applied the World Health Organization (WHO) 7-1-7 framework to assess timeliness of outbreak detection, notification, and early response. Intervals were classified against the ≤7-day, ≤1-day, and ≤7-day benchmarks, respectively. Five purposively selected key informants were interviewed to identify enablers, bottlenecks, and corrective actions. Interviews were transcribed and analyzed thematically according to the three 7-1-7 milestones.

The investigation was conducted as part of the public health response and classified as non-research/public health practice by the U.S. Centre for Disease Control and Prevention (CDC). Verbal consent and separate consent for audio-recording were obtained from interview participants.

Results

Summary of the cases identified

A total of 85 measles case-patients were identified during the investigation period, of whom 5 (5.9%) were laboratory-confirmed by measles-specific IgM detection and 80 (94%) were suspected cases. Of the 85 case-patients, 45 (53%) were female, and one death was recorded, giving a case fatality ratio of 1.2%.

7-1-7 timeliness milestone dates

Three intervals were assessed: detection (8 days; target ≤7), notification (1 day; target ≤1, met), and response (10 days; target ≤7). The district met the notification target only. The sections below describe findings and corrective actions for each interval.

Detection: The recognized outbreak cluster emerged on 7th March 2026 but was not detected until 15th March, eight days later, one day beyond the ≤7-day target. Detection was delayed by a sub-optimal community surveillance system, following a Village Health Team (VHT) restructuring that removed approximately 80% of trained volunteers.

"There is a weak community-based disease surveillance system, since all the VHTs have undergone restructuring where 80% have been dropped," noted the District Surveillance Focal Person (DSFP).

Low clinical suspicion and missing Integrated Disease Surveillance and Response (IDSR) job aids contributed to misclassification of suspected measles cases, and community reliance on traditional healers delayed care-seeking.

“In the register, the diagnosis is recorded as skin disease, and yet if further probed could be a suspected measles case", a health worker explained.

Notification: The District Health Officer (DHO) and Resident District Commissioner (RDC) were notified within one day of detection (15th March 2026), meeting the ≤1-day target. Escalation depended on a functional but informal vertical communication channel from the health sub-district to the district.

"It was notified on the evening of 15th March after receipt of the results. I promptly informed the RDC and DHO," the DSFP recounted.

Continues to page 22

Continued from page 21

Timeliness relied on individual initiative rather than written notification Standard Operating Procedures (SOPs).
Response: Completion of all early response actions took ten days from notification (15th–25th March 2026), exceeding the ≤7-day target by three days. Initial case management and infection prevention and control began within a day, but full multisectoral response was delayed by absent contingency funding, fragmented and short-lived partner support, and an under-prepared rapid response team (RRT).

"It is not easy to organize a meeting without facilitation. Meetings require facilitation, that the district did not have," said the District Cold Chain Technician (DCCT).
"Medical Teams International only covered the refugee settlement, while Baylor Uganda covered active case search for three days and then disappeared," the DSFP added.
Strong district leadership and Regional Emergency Operations Centre (EOC) support helped sustain the response despite resource constraints.

Table 1: Themes and corrective actions across 7-1-7 milestones, Kyegegwa District measles outbreak, Uganda, January–April 2026

Milestone	Theme	Finding & evidence	Corrective action
Detection *(Not met, 8*	Weak community surveillance	VHT restructuring cut ~80% of volunteers; community-based disease surveillance (CBDS) excluded from VHT training *("80% have been dropped" — DSFP)*	Refresher VHT training; integrate CBDS into routine activities
	Low clinical sus-	Measles misclassified as skin disease; no IDSR job aids	Refresher training; disseminate
	Delayed care-	Herbalist use and beliefs against moving the sick de-	Community sensitization on
	Lab turnaround delays	Results for first samples delayed; one death occurred pre-confirmation	Strengthen specimen referral; enable real-time electronic
Notification	Individual-driven timeliness	Rapid escalation relied on focal person's initiative, not SOP	Institutionalize written notification SOPs
Response *(Not met, 10*	No contingency funding	Coordination meetings depended on unguaranteed facilitation	Establish costed district contingency fund
	Fragmented partner support	Partner coverage geographically partial and short-lived	Pre-agreed partner mapping and response plan
	Under-prepared RRT	Team not fully deployed; no recent refresher/ simulation training	Periodic RRT simulation and refresher training

Discussion

The 7-1-7 assessment identified delays in measles outbreak detection and response in Kyegegwa District, while notification met the target. These delays reflected persistent gaps in community surveillance, clinical recognition, laboratory systems, and outbreak preparedness.

Detection exceeded the seven-day target by one day. Contributing factors included disruption of community surveillance following VHT restructuring, exclusion of community-based surveillance workers from refresher training (5,6), missing IDSR job aids, low clinical suspicion, delayed care-seeking (7,8) , and prolonged laboratory turnaround time. These factors reduced early case recognition and delayed outbreak confirmation.

Notification met the one-day target, with rapid escalation to district leadership once laboratory confirmation was received, indicating functional communication channels (3,9–11). However, reliance on individual initiative rather than standardized procedures may limit consistency in future outbreaks.

Response exceeded the seven-day target by three days. Although case management and infection prevention measures began promptly, full multisectoral response was delayed by lack of a district contingency fund, fragmented partner support, and incomplete rapid response team deployment (9–12).

Continues to page 23

Continued from page 22

Strong district leadership, Regional EOC engagement, and previous outbreak experience helped sustain the response despite these constraints. High population density and immunity gaps in Kyaka II refugee settlement may have further increased the response burden (4).

Study limitations: Timeliness dates were obtained from surveillance records and retrospective key-informant reports and may have been affected by recall or documentation errors. Findings from a single district and outbreak may not be generalizable. In addition, the 7-1-7 framework measures timeliness of actions but not their effectiveness in interrupting transmission.

Conclusion: Kyegegwa District met the 7-1-7 notification target but missed the detection and response targets, by one and three days, respectively. Detection was delayed by weakened community-based surveillance, low clinical suspicion, delayed care-seeking, and prolonged laboratory turnaround, and response was delayed by the lack of a district contingency fund, fragmented partner support, and an under-prepared rapid response team. Timely notification depended on individual initiative rather than standardized procedures. Strong district leadership and Regional Emergency Operations Centre support helped sustain the response. Strengthening community-based surveillance, clinical recognition, laboratory systems, standardized notification procedures, emergency financing, and rapid response team readiness could improve the timeliness of future outbreak detection and response.

Authors' contributions: AA: participated in the conception, investigation, design, analysis, and interpretation of the study and wrote the draft manuscript; LA, RK, MN, GT, PN, WA, CBM participated in the investigation and report writing. RM, BK and YN supervised the field data collection and reviewed the draft article for substantial intellectual content. All authors read and approved the final article.

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

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Continues to page 24

Continued from page 23

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Prevalence and Socio-behavioral Drivers of Measles-Rubella Vaccine Uptake Among Caregivers of Children During a Measles Outbreak, Kyegegwa District, January–April 2026

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Summary

Background: Behavioral and social factors play a critical role in shaping caregivers' decisions regarding childhood immunization. On March 20, 2026 in Kyegegwa District declared a measles outbreak when six children tested positive for IgM for measles. Among six laboratory-confirmed cases, three occurred in children who had never received the Measles-Rubella vaccine, while two cases had received only a single dose of the MR vaccine. We assessed behavioral and social drivers of measles-rubella (MR) vaccine uptake among caregivers of measles case-patients in Kyegegwa District, January−April, 2026.

Methods: We conducted a mixed-methods cross-sectional survey among caregivers of children aged 9-59 months in Kyegegwa District. Caregivers of case children were selected using simple random sampling from a line list as a sampling frame while caregivers of controls were systematically selected from household lists from the same neighborhood as case caregivers. Caregivers were interviewed using a structured questionnaire based on the World Health Organization Behavioral and Social Drivers of Vaccination framework. Measles-Rubella vaccine uptake (≥1 dose) was assessed, with predictors identified. Prevalence ratios were calculated using modified Poisson regression and quantitative data analyzed thematically.

Continues to page 25

Continued from page 24

Results: In total, 259 respondents participated in the study. Overall, prevalence of Measles-Rubella uptake was 82.24%. More than half of caregivers (53.7%) were between the ages of 25-39 years. The uptake of Measles-Rubella vaccines was associated with having had a health worker recommend vaccinating the child [aOR] 3.9; 95% [CI]: 1.5–10.4), perceived easy access to vaccination services (aOR 3.3; 95% CI: 1.1–9.8) and history of personally taking the child for vaccination (aOR 4.4; 95% CI: 1.6–12.3). Qualitative findings indicated that caregivers' trust in health workers, reminders from Village Health Teams, and convenient community outreach sessions were important enablers of vaccination. Some caregivers reported missed opportunities when they arrived late or vaccination services.

Conclusion: Measles-Rubella vaccine uptake was driven by caregiver agency, health worker recommendations, and localized convenience. To close remaining immunity gaps, public health strategies must address systemic missed opportunities by offering flexible outreach hours and empowering community health teams with targeted tracking.

Background

Measles remains one of the most contagious vaccine preventable diseases (VPD) and continues to pose a public health threat in many low- and middle-income countries despite the availability of a safe and effective vaccine[1]. Globally, sustained efforts led by the World Health Organization and partners have significantly reduced measles morbidity and mortality through routine immunization and supplementary campaigns from 145 to 49 cases per 1 million population from 2000 to 2018[2].

In Uganda, the introduction of the second dose of measles–rubella (MR) vaccine into the routine immunization schedule marked an important step toward eliminating both diseases[3,4]. However, a measles outbreak declared on March 20, 2026 in Kyegegwa District highlighted important immunization challenges. Among six laboratory-confirmed cases, three occurred in children who had never received the MR vaccine, while two cases had received only a single dose of the MR vaccine, instead of the recommended two doses. This pattern suggests a dual burden of missed access to immunization services and incomplete vaccination, pointing to both demand and supply side barriers within the health system.

Vaccination uptake is influenced by more than the availability of vaccines. The WHO Behavioral and Social Drivers of Vaccination framework identifies four domains that may influence uptake: thoughts and feelings about vaccination, social processes, motivation to vaccinate, and practical issues such as accessibility and service quality[5,6]. Caregivers may value childhood vaccination but still encounter barriers such as limited knowledge of the vaccination schedule, long distances to vaccination sites, inconvenient service-delivery arrangements, missed opportunities at health facilities, and inconsistent reminders or recommendations from health workers[6]. Understanding these factors is essential for designing locally appropriate interventions. We assessed behavioral and social drivers associated with MR vaccine uptake among caregivers of children in selected measles-affected sub-counties of Kyegegwa District between January and April, 2026.

Methods

We conducted a mixed methods cross-sectional study among caregivers of children in Kasule and Rwentuuha sub-counties, Kyegegwa District, Uganda. Respondents were caregivers of children aged 9-59 months residing in Kyegegwa District during between January−April 2026.Caregiver were defined as adults who were primarily responsible for an eligible child and able to report vaccination history. The primary outcome was the uptake of age-appropriate MR vaccine dose, defined as receipt of at least one dose of the MR vaccine in a child at 9 months and second of MR vaccine at 18 months. Explanatory variables were grouped according to the four domains of the Behavioral and Social drivers of Vaccination framework[7] .

We asked caretakers of both case-patients and control-persons about their thinking and feeling about vaccines, peer norms, practical issues and motivation factors that influence the uptake of Measles-Rubella vaccine. The vaccination status was obtained by checking the child vaccination.

Continues to page 26

Continued from page 25

For parents that did not have child vaccination cards, correctly pointing to the left upper arm vaccination site was considered an indicator for Measles-Rubella vaccination. Caregiver of case children were selected using simple random sampling using random numbers generated from excel from a line list as a sampling frame. Controls were systematically selected from household lists. Controls were selected from the same village and within the same age category.

This outbreak investigation was in response to a public health emergency. The Ministry of Health (MoH) gave permission to investigate this outbreak. In agreement with the International Guidelines for Ethical Review of Epidemiological Studies by the Council for International Organizations of Medical Sciences (1991) and the Office of the Associate Director for Science, US CDC/Uganda, it was determined that this activity was not human subject research. Informed consent was obtained from caregivers prior to data collection.

Results

Participant characteristics and Measles-Rubella vaccination status

A total of 259 caregivers participated in the survey. The prevalence of Measles-Rubella vaccine uptake 82.24% (213/259) among respondents. Most caregivers were aged 25–39 years 53.7% (139/259) and had attained primary education 59.5% (154/259) as shown in Table 1.

Thoughts and feelings about vaccination

Overall, 251/259 (96.9%) considered childhood vaccines safe, 96.1% (249/259) considered vaccines important for their children's health, and 96.9% (251/259) reported trust in health workers who provided vaccination services. However, knowledge of the recommended MR vaccination schedule was limited: only 19.3% (50/259) caregivers correctly identified the number of MR vaccine doses required for full protection.

Continues to page 27

Continued from page 26

Table 1: Characteristics of caregivers and selected behavioral and social drivers of Measles-Rubella vaccination Kyegegwa, January – April 2026

Characteristic	Category	n=259	%
Caregiver characteristics			
Age category (years)	<25	44	17.0
	25–39	139	53.7
	≥40	76	29.3
Education level	No formal education	59	22.8
	Primary	154	59.5
	Secondary	39	15.1
	Tertiary or university	7	2.7
MR vaccination status among children assessed			
Receipt of at least one MR vaccine dose*	Yes	213	82.24
	No	46	17.76
Thoughts and feelings			
Perceived childhood vaccines as safe	Yes	251	96.9
Perceived childhood vaccines as important	Yes	249	96.1
Trusted health workers who provide vaccination	Yes	251	96.9
Correctly identified the recommended number of MR doses	Yes	50	19.3
Motivation			
Wanted child to receive all routine vaccines	Yes	242	93.4
Social processes			
Reported recommendation from religious leader	Yes	244	94.2
Reported recommendation from family member	Yes	231	89.2
Reported recommendation from community leader	Yes	250	96.5
Reported recommendation from health worker	Yes	229	88.4
Received reminder that child was due for vaccination	Yes	134	51.7
Practical issues			
Distance to nearest government or PNFP health facility	<1 km	11	4.2
	1–5 km	145	56.0
	>5 km	103	39.8
Reported easy access to vaccination services	Yes	234	90.3
Incurred costs while seeking vaccination services	Yes	70	27.0
Satisfied with vaccination services	Yes	247	95.4
Knew where to obtain vaccination services	Yes	255	98.5
Personally, took child for vaccination	Yes	235	90.7
Reported ever being turned away from vaccination	Yes	26	10.0

Continues to page 28

Continued from page 27

Motivation and social processes

Most caregivers 93.4% (242/259) wanted their children to receive all vaccines included in the national immunization schedule including the 2 doses of the MR vaccine. More the a third 88.4% (229/259) of caregivers reported receiving a recommendation from a health worker, 89.2% (231/259) from a family member, 94.2% (244/259) from a religious leader, and96.5% (250/259) from a community leader. Approximately half of caregivers 51.7% (134/259) reported receiving reminders that their children were due for vaccinations.

Practical issues affecting access to vaccination services

Most caregivers 90.3% (234/259) reported that vaccination services were easy to access, and 95.4% (247/259) were satisfied with the services received. However, 27.0% (70/259) reported incurring costs while seeking vaccination services, and 10.0% (26/259) reported that they had previously been turned away from a vaccination site. Almost all caregivers 98.5% (255/259) knew where to obtain vaccination services (Table 1).

Factors associated with Uptake of Measles-Rubella vaccine among caregivers of children during a measles outbreak, Kyegegwa District, January-April 2026

In the multivariable analysis (Table 2), caregivers who reported receiving a health-worker recommendation to vaccinate had higher odds of Measles-Rubella vaccine uptake by their children compared to caregivers did not report receiving such a recommendation (aOR 3.90; 95% CI: 1.45–10.42). Caregivers who reported that vaccination services were easy to access also had higher odds of having their children vaccinated with the MR vaccine compared to caregivers who reported difficulty accessing services (aOR 3.30; 95% CI: 1.12–9.79). Caregivers who reported personally taking their children for vaccination were also more likely to take their children for MR vaccination (aOR 4.40; 95% CI: 1.56–12.30). Because this measure is closely related to the outcome, it should be interpreted cautiously as a proximal indicator of caregiver engagement rather than as an independent causal determinant. Other variables included in the adjusted model were not statistically associated with MR vaccination.

Table 2: Factors associated with Measles-Rubella vaccination among children during a measles outbreak, Kyegegwa District, January –May 2026

Characteristic	Reference category	cOR (95% CI)	aOR (95% CI)	p-value
Age <25 years	25–39 years	0.59 (0.22–1.58)	0.70 (0.22–1.20)	0.450
Age ≥40 years	25–39 years	0.34 (0.16–0.72)	0.50 (0.19–1.09)	0.080
Perceived vaccines as safe	No	3.47 (0.80–15.14)	3.10 (0.40–24.41)	0.280
Trusted health workers	No	3.47 (0.80–15.14)	1.60 (0.22–11.18)	0.660
Received health-worker recommendation	No	5.72 (2.50–13.07)	3.90 (1.45–10.42)	0.007
Received vaccination-due reminder	No	1.98 (0.99–3.97)	1.10 (0.49–2.49)	0.820
Reported easy access to vaccination services	No	6.79 (2.82–16.35)	3.30 (1.12–9.79)	0.031
Satisfied with vaccination services	No	2.93 (0.84–10.24)	0.90 (0.17–5.62)	0.990
Personally, took child for vaccination	No	7.39 (3.03–18.04)	4.40 (1.56–12.30)	0.005
Reported ever being turned away	No	0.45 (0.17–1.15)	0.60 (0.18–1.70)	0.300

cOR: crude odds ratio; aOR: adjusted odds ratio; CI: confidence interval.

Qualitative findings

The qualitative findings supported the quantitative results. Caregivers described trust in health workers, reminders from Village Health Teams (VHTs), and convenient community outreach sessions as important enablers of vaccination. Some caregivers also reported missed opportunities when caregivers arrived late or vaccination services were no longer available

Continues to page 29

Continued from page 28

Table 3: Illustrative qualitative findings related to Measles-Rubella vaccination in Kyegegwa District, January–May2026.

Theme	Summary	Illustrative quotation
Health-worker and VHT reminders	Caregivers described reminders from VHTs and health workers as prompts to attend outreach vaccination ses-	*"Our VHT always passes around ... informing us that vaccination of children is the next day, so we should take our children there for vaccination."*
Convenient outreach services	Community outreach sessions reduced travel time and made vaccination easier to access.	*"The vaccinators are near our home, at the mango tree in the trading center ... by midday I am back home with my children vaccinated."*
Missed opportunities	Some caregivers described being turned away when they arrived after	*"Some friends of mine were turned away because they ... arrived late."*

Discussion

Using the WHO Behavioral and Social Drivers framework, this study found that MR vaccine uptake among children in Kyegegwa District was associated with healthcare-worker recommendation, ease of access to vaccination services, and caregivers personally taking their children for vaccination. These findings highlight the importance of social influence and practical factors in caregivers' vaccination decisions.[8,9]

Healthcare-worker recommendation was associated with increased MR vaccine uptake. Healthcare workers and Village Health Teams are trusted sources of vaccination information and play an important role in mobilizing caregivers, particularly in communities served through outreach services[10].

Easy access to vaccination services was also associated with uptake, consistent with studies showing that proximity to vaccination services improves childhood vaccination[11,12] . In Kyegegwa, community outreach sessions may have reduced distance-related barriers by bringing vaccination services closer to caregivers.

Children whose caregivers personally took them for vaccination were also more likely to receive MR vaccine. Direct interaction with healthcare workers may provide caregivers with information on vaccine benefits and subsequent vaccination dates, supporting completion of the vaccination schedule[9].

Study limitations: Vaccination status was based on caregiver recall when vaccination cards were unavailable, which may have introduced recall or misclassification bias.

Conclusion: During the January–May 2026 measles outbreak in Kyegegwa District, healthcare-worker recommendation, easy access to vaccination services, and caregivers personally taking children for vaccination were associated with increased MR vaccine uptake. The district should strengthen healthcare-worker and Village Health Team communication, maintain accessible and predictable outreach services, provide vaccination reminders, and reinforce caregiver education on the two-dose MR vaccination schedule

Author's contributions: CMB conceptualized the study, led data collection and analysis and drafted the manuscript. GT, MN, LA, AA, NR, WA, NP, RK, EN supported data collection and cleaning.RM, KB, YN, AA provided technical input during study design and data interpretation. All the authors read and approved the bulletin.

Declaration of interest: The authors declare no conflict of interest

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Continues to page 30

Continued from page 29

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Prevalence and Factors Associated with Measles-Rubella Zero-Dose Status During a Measles Outbreak, Kyegegwa District, Uganda, April, 2026

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Summary

Background: The growing number of zero-dose children, those who have never received a routine vaccine, poses a major threat to global immunization efforts and increases the risk of vaccine-preventable disease outbreaks. Although the first dose of the diphtheria-tetanus-pertussis-containing vaccine (DTP1) is commonly used as the global indicator of zero-dose status, children who have not received the measles-rubella (MR) vaccine remain highly susceptible to measles outbreaks. Recurrent measles outbreaks in Kyegegwa District, Uganda, suggest persistent gaps in routine immunization

Continues to page 31

Continued from page 30

and the presence of children who remain unvaccinated against measles. We assessed the prevalence of MR zero-dose status and identified factors associated with being MR zero-dose among children aged 9–59 months, Kyegegwa District, Uganda, April 2026.

Methods: We conducted a cross-sectional household survey in the two sub-counties most affected by the measles outbreak in Kyegegwa District, Uganda. Children aged 9–59 months were selected from 255 children that were recruited for the study using a multi-stage cluster sampling design. Data were collected through caregiver interviews using a structured questionnaire and by reviewing vaccination cards. Weighted prevalence estimates of MR zero-dose status were calculated. Multivariable logistic regression was used to identify factors independently associated with MR zero-dose status, with results reported as adjusted odds ratios (aORs) and 95% confidence intervals (CIs).

Results: Out of 156 children eligible for MR vaccination, 24% (38/156) were zero-dose. MR zero-dose status was slightly higher among children aged 9–17 months (30%) than among those aged 18–59 months (23%). Male children had a higher prevalence of MR zero-dose status (27%) than female children (22%). The factors associated with zero-dose MR vaccination included education (aOR = 0.14, 95% CI: 0.03–0.7; p = 0.017), and caregivers being unaware of the time of vaccination (aOR = 7.0, 95% CI: 1.2–41.2; p = 0.031). Children with caregivers who had a secondary level education or higher were less likely to miss MR vaccination.

Conclusion: Almost a quarter of children affected by the measles outbreak had never received the measles-rubella vaccine. Children whose caregivers were knowledgeable about the importance of vaccination understood why and when vaccines should be given, and those whose caregivers had more education were less likely to be zero-dose. We recommend prioritizing community-based immunization education and targeted outreach programmes to improve caregivers' awareness of the importance of vaccination, and the vaccination schedules, especially among populations with low education levels.

Background

Measles-rubella vaccination is essential to prevent outbreaks and reduce childhood morbidity and mortality [1, 2]. However, suboptimal vaccination coverage continues to leave many children susceptible to infection, particularly in low-income countries [3, 4 &5].

In March 2026, a measles outbreak was confirmed in Kyegegwa District, Uganda, after children from Ruhangiire Parish presented with symptoms consistent with measles and five of six specimens tested positive. The outbreak subsequently spread to additional communities and disproportionately affected children under five years [6, 7]. It occurred amid suboptimal routine measles-rubella vaccination coverage, particularly for the second dose.

Because many affected children were zero-dose or under-immunized [8], we assessed the prevalence of measles-rubella zero-dose status and associated factors among children aged 9–59 months in Kyegegwa District to inform targeted interventions for improving routine immunization coverage and preventing future outbreaks.

Methods

We conducted a secondary analysis of data collected during the measles outbreak response in Kyegegwa District, Uganda, in April 2026. During the outbreak response, data were collected from 255 children identified through household and community investigations in the two sub-counties most affected by the outbreak. For this analysis, we restricted the dataset to children aged 9–59 months, the age group eligible to have received measles-rubella (MR) vaccination through routine immunization. A total of 156 children met this eligibility criterion and constituted the analytical population for assessing MR zero-dose status. No separate sample-size calculation was performed as the analysis used all eligible children available from the existing outbreak-response dataset.

Continues to page 32

Continued from page 31

MR zero-dose status was defined as having received no dose of the measles-rubella vaccine. Vaccination status was determined through review of vaccination cards and health-facility records where available; where documented evidence was unavailable, caregiver recall was used. Children were classified as MR zero-dose or not zero-dose after their vaccination status had been determined. Independent variables included child characteristics, caregiver socio-demographic characteristics, household factors, access to immunization services, caregiver knowledge of the vaccination schedule and attitudes towards vaccination, and selected health-system factors.

Using a structured questionnaire programmed in Kobo Collect we conducted face to face interviews with the caregivers. Vaccination cards were reviewed to verify immunization status whenever available. Data were cleaned and analyzed using Stata version 19. Sampling weights were applied to account for the multistage sampling design, and weighted prevalence estimates of MR zero-dose status were calculated. Descriptive statistics were used to summarize participant characteristics. The prevalence of MR zero-dose status was calculated as the proportion of children who had received no dose of MR vaccine. Sampling weights were applied in analyses accounting for the multistage sampling design. Bivariable logistic regression was performed to examine associations between independent variables and MR zero-dose status. Variables with a p-value <0.20**,** together with variables considered biologically important, were entered into a multivariable logistic regression model to identify factors independently associated with MR zero-dose status. Adjusted odds ratios (aORs) with 95% confidence intervals (CIs) were reported, and statistical significance was assessed at the 5% level (p<0.05)**.**

This study was conducted as part of the Uganda Ministry of Health response to the measles outbreak. We obtained written informed consent from all participating caregivers before data collection began.

Results

Prevalence of MR Measles- Rubella zero-dose status among children aged 9 to 59 months, Kyegegwa District, Uganda, April 2026

The prevalence of MR zero-dose status among children eligible for MR vaccination was 24.4%. Children aged 9–17 months had a higher prevalence (30.0%) than those aged 18–59 months (23.0%). Similarly, male children had a higher prevalence of MR zero-dose status (27.4%) than female children (21.7%). Children whose caregivers had no formal education had the highest prevalence of MR zero-dose status (31.2%), while those with secondary education had the lowest prevalence (3.6%).

Factors associated with Measles-Rubella Measles-Rubella zero-dose status among children aged 9-59 months Kyegegwa District, Uganda, April 2026

Caregivers with secondary school education and above were less likely to have zero-dose children than those with no education -3.6% (aOR=0.14; 95% CI: 0.03-0.70; p=0.017). Higher proportions of zero-dose children were also observed among caregivers who were unaware of the time of vaccination -23% (aOR=7.01; 95% CI: 1.2–41.2; p=0.031) (Table 1). No meaningful differences were observed by child age or sex. Overall, caregiver education was the factor most strongly associated with MR zero-dose status in the adjusted analysis.

Continues to page 33

Continued from page 32

Table 1: Factors associated with Measles-Rubella zero-dose status among children aged 9-59 months, Kyegegwa District, Uganda, April 2026

Variables	Zero-dose %			
	Yes	No	cOR(95%CI)	aOR(95%CI)
Age Category-Care giver				
<24	26	74	Ref	
25-39	23	77	1.3(0.54-3.3)	
40+	28	72	1.2(0.47-3.1)	
Sex of the Caregiver				
Female	24	76	Ref	
Male	29	71	1.3(0.44-4.1)	
Education of Caregiver				
None	31	69	Ref	
Primary	19	81	0.52(0.21-1.3)	0.61(0.25-1.5)
Secondary+	4	96	0.080(0.10-0.69)	0.14(0.027-0.70)
Religion				
Christians	13	87	Ref	
Others	23	77	1.93(0.63-5.9)	
Distance from the Nearest Health				
<1km	33	67	Ref	
1-5km	26	74	0.70(0.12-4.2)	
>5km	23	77	0.59(0.10-3.5)	
Decision Maker				
Father	27	73	Ref	
Mother	26	74	0.77(0.26-2.3)	
Other	16.7	83.3	0.55(0.17-1.8)	
Health Worker Trust				
Trust	23	77	Ref	
No trust	60	40	0.20(0.32-1.3)	
Knowledge of Importance of Vac-				
Knowledgeable	23	77	Ref	
Not Knowledgeable	57	43	0.22(0.47-1.0)	0.20(0.40-1.0)
Safety Perception				
Safe	24	76	Ref	
Not Safe	33	67	0.63(0.11-3.6)	
Satisfaction				
Yes	24	76	Ref	
No	29	71	0.80(0.15-4.3)	

Continues to page 34

Continued from page 33

Discussion

This study found that 24% of MR-eligible children in the assessed sub-counties of Kyegegwa District were zero-dose, indicating substantial immunity gaps that likely contributed to the measles outbreak [9]. Caregivers with secondary education or higher were less likely to have zero-dose children [10, 11], while caregivers who did not know when children should be vaccinated were more likely to have unvaccinated children [12]. These findings suggest that caregiver education, awareness, and understanding of vaccination schedules remain important determinants of MR vaccine uptake [13, 14].

Improving caregiver knowledge and strengthening communication on the importance and timing of routine vaccination may help reduce missed vaccination opportunities [15]. Health workers, Village Health Teams, community leaders, and other trusted community structures should be engaged to identify zero-dose children, reinforce vaccination messages, support defaulter tracing, and conduct targeted outreach in communities with persistent immunity gaps [16]. These approaches could reduce the accumulation of susceptible children and help prevent future measles outbreaks.

Study limitations: The relatively small sample of 156 children reduced the precision of some estimates, resulting in wide confidence intervals. Vaccination status was based on caregiver recall when vaccination cards were unavailable, which may have introduced recall or misclassification bias. Because the two most affected sub-counties were purposively selected, the findings may not be generalizable to the entire district. In addition, the cross-sectional design limits assessment of temporality between caregiver characteristics and vaccination status.

Conclusion: Nearly one in four MR-eligible children in the assessed communities had never received an MR vaccine dose. Zero-dose status was associated with caregiver education and knowledge of vaccination timing. Strengthening caregiver awareness, community engagement, routine immunization communication, and targeted outreach to identify missed children could improve MR vaccination uptake and reduce the risk of future measles outbreaks in Kyegegwa District.

Conflict of Interest: None declared.

Authors Contributions: NM participated in conception, design, data analysis and interpretation of the study and wrote the draft analysis. GT, PN, WA, RN, CBM, AA, LA, RK AND YN reviewed the report and the draft manuscript and made several improvements to it. BK and RM reviewed the final bulletin. All authors read and approved the final article.

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Healthcare–seeking behaviour among caregivers of children with suspected measles in Kyegegwa District, Uganda, January–April 2026

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Summary

Background: On March 20, 2026, the Ministry of Health confirmed a measles outbreak in Kyegegwa District after five of six samples from suspected measles cases tested positive with one death reported. We described healthcare-seeking behaviour and identified factors associated with delayed formal care-seeking among caregivers of children with suspected measles during the outbreak investigation, January–April 2026.
Methods: We conducted a mixed-methods cross-sectional study among 85 caregivers of children with suspected measles identified during active case search in the two most affected sub-counties. We used structured questionnaires to collect quantitative data from caregivers.

Continues to page 36

Continued from page 35

Qualitative data were collected through interviews with four community caregivers and two Village Health Team (VHT) members. We defined delayed formal healthcare-seeking as seeking care at a health facility more >48 hours after rash onset or not seeking formal care. We defined a caregiver as knowledgeable if they could name >2 symptoms of measles based on the community case definition of measles. We used logistic regression to identify factors associated with delayed care-seeking.
Results: Among 85 caregivers, 53 (62%) delayed seeking formal healthcare. Only 24 (28%) first sought care at a health facility. The remaining caregivers first used home remedies (31; 36%), sought care from traditional healers or used traditional herbs (15;18%), purchased medicines from drug shops or private clinics (9; 11%), did nothing (4; 5%), or first consulted a VHT (2;2%). Delay was associated with caregiver knowledge of measles (adjusted odds ratio (aOR)=5.28; 95% confidence interval (CI): 1.63–17.16). and travel time ≥60 minutes to reach a health facility had higher odds of delayed care-seeking (aOR=4.93; 95% CI: 1.50–16.12). Qualitative findings added care at home, herbal remedies, advice from relatives, transport costs, medicine stock-outs and long waiting times.
Conclusion: Delayed care-seeking were attributed to home-based treatment, sociocultural, geographic, financial, and health-system barriers. Interventions aimed at addressing community level and health -system factors could help reduce delays.

Background

Measles is a highly contagious viral disease spread through respiratory droplets or direct contact [1] . Despite having a safe and effective vaccine, it remains an important cause of death among young children globally, and can cause serious adverse outcomes such as blindness, pneumonia and encephalitis [2] .

Healthcare-seeking behaviour is any action or inaction undertaken by individuals who perceive themselves to be ill, to find an appropriate remedy [3] . Early and appropriate health-seeking behaviour among measles case-patients enables prompt clinical assessment, supportive treatment, management of complications, case notification, investigation, and contact tracing [4] .

Delayed care-seeking of suspected measles may increase the risk of complications and continued community transmission [5] . In rural Uganda, caregivers commonly begin treating childhood illness at home with traditional or herbal remedies before seeking formal care, influenced by cultural beliefs, family advice, and confidence in traditional medicine [6] .

On March 20, 2026, Ministry of Health (MOH) confirmed a measles outbreak in Kyegegwa District after five of six samples from suspected measles cases tested positive with one death reported. Confirmed cases were reported from Ruhangire Parish, Rwentuha Sub-county, where preliminary findings suggested immunisation gaps and delayed or absent healthcare-seeking at health facilities. We determined the healthcare-seeking behaviour and identified associated factors among caregivers of children with suspected measles in Kyegegwa District, Uganda from January to April 2026.

Methods

Kyegegwa District, in Toro sub-region, has a population of 501,120 [7] , and has a mixed health service delivery system comprising government health centres at levels II through IV, one district hospital, and private not-for-profit facilities.

We conducted a cross-sectional mixed methods study in the two most-affected sub-counties, Kasule and Rwentuha. A total of 85 caregivers were identified through active case finding and assessed based on availability. A caregiver was defined as the person primarily responsible for a child with suspected measles. A suspected case of measles was defined as fever and a maculopapular rash with at least one of the following symptoms: cough, coryza (runny nose), or conjunctivitis (red eyes) in a resident of Kyegegwa District from January to April, 2026.

Caregivers of cases were interviewed on caregiver and child characteristics plus potential risk factors for delay to seek formal healthcare. We defined knowledge as knowing >2 symptoms of measles by the care givers. Key informant interviews with VHTs explored community care-seeking patterns, barriers and enablers to early healthcare-seeking.

Continues to page 37

Continued from page 36

We used logistic regression to assess the association with delayed care-seeking and inductive thematic analysis for qualitative data.

We conducted this study in response to the outbreak in Kyegegwa District with permission from Ministry of Health Uganda and district health authorities. A non-research determination was obtained from the Associate Director for Science, US CDC Uganda. Verbal informed consent was obtained from all participants prior for clarity and easy communication. Participation was voluntary and confidentiality was maintained by anonymising data and secure handling throughout.

Results

Descriptive characteristics among suspected measles cases and caregivers in Rwentuha and Kasule sub counties in Kyegegwa District, January–April 2026

A total of 85 caregivers participated in the quantitative survey. Of these, 75 (88%) were female. The median age of care givers was 34 years. Most caregivers attained primary-level education 51(60%). Most caregivers were engaged in farming 78(92%). The median age of the children with suspected measles was 46 months, with most aged 18–59 months.

First action taken by caregivers of children with suspected measles after symptom onset in Rwentuha and Kasule sub counties, Kyegegwa District, January–April 2026

The most common initial action was using home remedies (Figure 1).

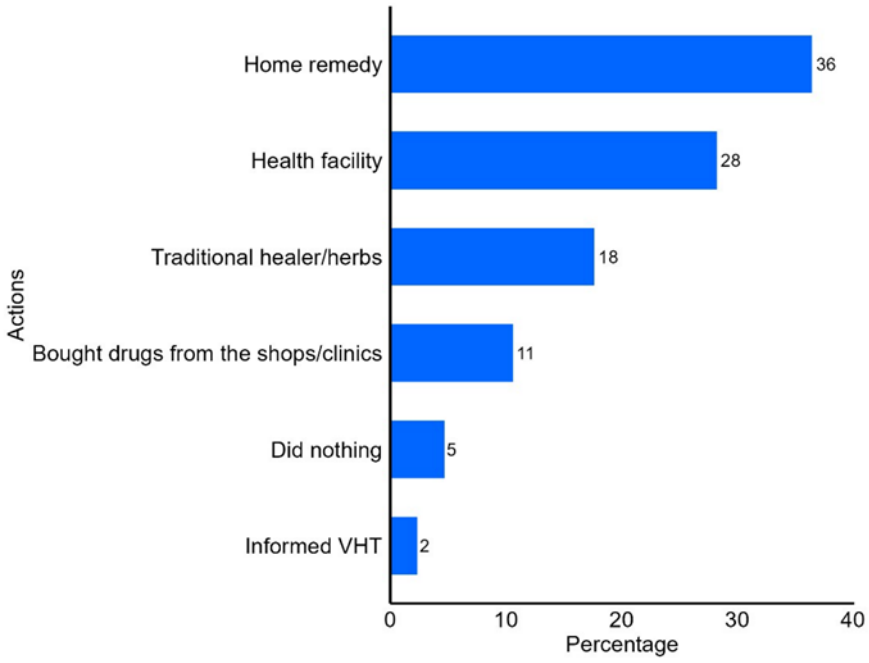


Figure 1: First action taken by caregivers of children with suspected measles in Kyegegwa district, January–April 2026

Delayed healthcare-seeking among caregivers of children with suspected measles, Rwentuha and Kasule sub counties, Kyegegwa District, January–April 2026

Nearly two-thirds of caregivers delayed seeking formal healthcare for children with suspected measles.

Continues to page 38

Continued from page 37

Table 1: Factors associated with delay in seeking formal care among caregivers of children with suspected measles, Kyegegwa District, Uganda, January–April 2026

Characteristic	Total n (%)	Delayed n (%)	cOR	aOR
Time taken to reach nearest health facility				
0-59 minutes	52 (61)	28 (54)	ref	ref
60 and above minutes	33 (39)	25 (76)	2.68(1.02-7.02)	4.93(1.50-16.12)
Caregiver knowledge				
Yes	50 (59)	37 (74)	3.38(1.35-8.45)	5.28(1.63-17.16)
No	35 (41)	16 (46)	ref	ref

cOR: *Crude odds ratio;* ***aOR:*** *Adjusted odds ratio;* ***ref:*** *Reference category*

Time taken to travel to the health facility of ≥60 minutes was associated with over 4 times the odds of delay (aOR=4.93, 95% CI:1.50-16.12, p=0.008). Caregiver knowledge about measles was similarly associated with increased odds of delay in seeking formal healthcare (aOR=5.28, 95% CI:1.63-17.16, p=0.006) (Table 1).

Qualitative factors associated with delay in seeking formal care among caregivers of children with suspected measles in Rwentuha and Kasule sub counties, Kyegegwa district, January–April, 2026

Caregivers described several factors contributing to delayed healthcare seeking, including home-based treatment, use of herbal remedies, advice from relatives, transport costs, medicine stock-outs, and long waiting times. These findings illustrate the range of experiences reported by the caregivers of children with suspected measles.

Home management of measles first: Most caregivers first managed the child at home, and sought formal care when only when symptoms persisted or worsened. One caregiver explained, *"I first gave her panadol and then looked for herbs*...."

Herbal medicine as an important alternative treatment: Both caregivers and VHTs commonly described treating children with suspected measles at home with herbal medicine and taken to the later for final management, a practice called "*omutasyo*".

> *"Most of the people know the herbs and get them themselves. The process of using herbs is called 'omutasyo'. When they get better, that is when they are taken to the hospital to check if they healed...*" (VHT)

Perceived severity of the disease: Caregivers sought facility care mainly once illness appeared severe for example, a child with fever, vomiting, and bloody diarrhoea. Milder symptoms were treated with herbs alone after the fever subsided. One caregiver explained,

> *"She was not very sick so I got for her herbs and the rash started drying, so I didn't see the use since the fever was gone" (Caregiver)*

Structural, economic, and health-system barriers: Distance to health facilities, cost of transport, were frequently mentioned as challenges, particularly for households with limited financial resources. One VHT noted, *"…caregivers can be lazy because of distance, may not have money for transport".* Caregivers also described medicine shortages, long waits, understaffing, and referrals to other government facilities, as well as poor road conditions during heavy rain, as further deterrents.

Community influence: Family members, friends, neighbours, and other community members shaped care-seeking decisions. One caregiver explained, *"I talked to my mother and explained to her how the children were, she told me to get herbs...".*

Continues to page 39

VHTs as facilitators: VHTs identified suspected cases, educated caregivers, referred children to facilities, wrote referral notes when caregivers reported illness to them and followed up. One VHT reported, *"When one is sick, they report to us and we inform the in-charge, then write a referral note for them to go to the hospital..."*

Discussion

Delayed care-seeking for suspected measles appeared to reflect an interaction of geographic, sociocultural, financial, and health-system factors. Long travel times can discourage or postpone use of formal healthcare, particularly in rural and hard-to-reach communities, as reported in other African settings.

Caregiver knowledge of measles did not necessarily translate into earlier formal care-seeking. Similar findings have been reported elsewhere, suggesting that knowledge alone may be insufficient to promote timely healthcare use [8–10] . Caregivers who recognize measles may initially feel confident managing the illness at home and seek facility care only when symptoms worsen [8–11] . Health education should therefore emphasize not only recognition of measles but also the importance of early assessment and danger signs requiring prompt referral.

Home remedies and traditional treatments were commonly influenced by advice from relatives and community members, reflecting the role of family and social norms in care-seeking decisions [6,9] . Decisions to seek formal care were further influenced by distance, transport costs, poor road conditions, waiting times, medicine availability, and perceptions of service quality, consistent with evidence from other African settings [10,12–15] .

Village Health Teams can help address some of these barriers through community education, early identification of suspected cases, referral, and follow-up. Strengthening their role may support earlier linkage of children with suspected measles to appropriate health services [16] .

Study limitation: The study included only caregivers of suspected measles cases identified during the outbreak, resulting in a relatively small sample. Small numbers in some variable categories reduced the precision of association estimates, and the findings may not be generalizable beyond the outbreak setting.

Conclusion: Delayed care-seeking for suspected measles was influenced by home-based treatment practices, social and cultural influences, geographic and financial barriers, and health-system factors. Addressing both community- and health-system barriers is important for promoting timely care-seeking during measles outbreaks.

Health authorities should strengthen VHT-led community education and referral, emphasize the risks of delaying formal care for suspected measles, and address misconceptions about home and traditional treatment. Health facilities should also improve availability of essential medicines, adequate staffing, and timely service delivery to reduce barriers to early care-seeking.

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Author contributions: EN led conceptualisation, data collection, analysis and writing. GT, RN, MN, AA, RK, LA, PN, CMB and WA were involved in the investigation and data collection. BK, RM and YN provided supervision.

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

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Continues to page 41

Continued from page 40

Systematic Multi-Platform Laboratory Investigation of a Disease of Unknown Aetiology in Rubirizi District, Uganda, December 2025

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Summary

Background: Outbreaks of unknown aetiology present diagnostic and therapeutic challenges to public health systems. In the absence of a confirmed diagnosis, empirical antimicrobial treatment may be necessary but can increase unnecessary antimicrobial exposure and selection pressure for antimicrobial resistance (AMR). On November 26, 2025, the Ministry of Health received an alert of an illness of unknown aetiology in Kyabakara Subcounty, Rubirizi District. Thirteen cases, including four deaths, were identified, characterized by unilateral, fluid-filled blisters on the lower limbs that progressed to severe, non-healing ulcers. We conducted systematic, multi-platform laboratory investigations to identify possible causes, guide clinical management, and support public health decision-making.

Methods: Clinical samples including wound swabs, blood, and skin snips were collected and analyzed from eighteen cases. Environmental samples were collected from affected cases homes. Multi-platform diagnostic framework was utilized including microscopy, serology, histopathology, molecular diagnostics, heavy metal analysis, and genomic sequencing. Bacterial cultures and antimicrobial susceptibility testing (AST) were used to identify and establish the resistance profiles to guide treatment decisions.

Results: Of the eighteen (18) patients tested, 1 (6%) was positive for malaria, while 1 (6%) was positive for filarial worms. One (6%) tested positive for leishmaniasis, while another (6%) was positive for Rift Valley fever and 1 (6%) had Kaposi sarcoma. No acid-fast bacilli were detected for *Mycobacterium* species. Among the heavy metals analysed only Iron was detected in the soil samples. All eighteen patients (100%) were negative for anthrax and whole genome sequencing did not identify any pathogen that adequately explained the patients' clinical symptoms. Bacterial culture and antimicrobial susceptibility testing identified *Pseudomonas putida*, *Pseudomonas* spp, *Citrobacter freundii*, and *Klebsiella pneumoniae* and *Staphylococcus aureus*. One (6%) of the patients had extended-spectrum β-lactamase (ESBL) producing *K. pneumoniae*. *S. aureus* isolates from one patient (6%) demonstrated methicillin resistance (MRSA) and β-lactamase production.

Conclusion: Establishing a standardized national testing algorithm improves diagnostic efficiency, and supports public health decision-making during outbreaks of unknown aetiology. The detection of ESBL-producing *K. pneumoniae* and methicillin-resistant and β-lactamase-producing *S. aureus* highlights the resistance to commonly used antibiotics. These results guided appropriate treatment of secondary bacterial wound infections and supported antimicrobial stewardship.

Background

On 26 November 2025, Uganda's Ministry of Health received an alert of community deaths from an unknown illness in Kyabakara Sub-county, Rubirizi District. Between March and December 2025, 13 cases were identified, including four deaths (31%). The illness was characterized by unilateral fluid-filled blisters on the lower limbs that progressed to severe, non-healing ulcers.

Continues to page 42

Continued from page 41

Chronic ulcers can have infectious and non-infectious causes, making diagnosis difficult when clinical features are non-specific. In outbreaks of unknown aetiology, delayed diagnosis may lead to prolonged empirical treatment and inappropriate antimicrobial use. Laboratory investigation is therefore essential to identify potential causes and guide clinical management and public health response (1).

We used a multi-platform laboratory testing approach to investigate the aetiology of the illness and inform treatment, antimicrobial stewardship, and outbreak-control decisions.

Methods

We conducted the investigation in Rubirizi District, western Uganda, a predominantly rural farming district that includes part of Queen Elizabeth National Park.

Clinical specimens, including wound swabs, blood, and skin snips, were collected from 18 case-patients, together with soil samples from affected households. Microscopy and serology were performed at Rugazi Health Centre IV, histopathology at Mulago National Referral Hospital, heavy-metal testing at the Directorate of Government Analytical Laboratory, pathogen discovery at the Uganda Virus Research Institute, bacterial culture and antimicrobial susceptibility testing at the National Microbiology Reference Laboratory, and genomic sequencing at the National Genomic Sequencing Laboratory.

The investigation was conducted as part of the Ministry of Health emergency public health response and was determined to be non-research by US CDC. Verbal informed consent was obtained from participants, and confidentiality was maintained through secure data storage.

Results

Of the eighteen patients' samples tested, one (6%) was positive for malaria, while one (6%) was positive for filarial worms by microscopy and antigen testing. One (6%) tested positive for leishmaniasis, while another (6%) was positive for Rift Valley fever and 1 (6%) was positive for Kaposi sarcoma. No (0%) acid-fast bacilli were detected by microscopy for *Mycobacterium* species, Random blood glucose, complete blood count, and renal function tests results were within normal limits for all patients tested. Among the heavy metals analysed only Iron was detected in the soil samples, Aluminium, Iron, Arsenic, Cadmium, Mercury and lead were not detected. All eighteen patients (100%) were negative for anthrax and whole genome sequencing did not identify any pathogen that adequately explained the patients' clinical symptoms. Pathogen discovery identified *Mycobacteroides abscesses* and *Paraburkholderia fungorum* in two cases (11%). Bacterial culture and antimicrobial susceptibility testing identified several bacterial species, including Gram-negative organisms such as *Pseudomonas putida*, *Pseudomonas* spp, *Citrobacter freundii*, and *Klebsiella pneumoniae*, as well as the Gram-positive bacterium including *Staphylococcus aureus*. Out of the eighteen (18) patients whose samples were tested One (6%) patients had extended-spectrum β-lactamase (ESBL) producing *K. pneumoniae*. *S. aureus* isolates from one patient (6%) demonstrated methicillin resistance (MRSA) and β-lactamase production.

Discussion

The detection of ESBL-producing *K. pneumoniae* and methicillin-resistant and β-lactamase-producing *S. aureus* highlights the presence of clinically important antimicrobial resistance and the potential limitations of empirical antibiotic treatment applied before the investigation (2). These results underscored the importance of antimicrobial susceptibility testing to guide appropriate treatment and support antimicrobial stewardship (3).

The detection of iron in soil samples was also noteworthy but cannot, by itself, establish an environmental cause of illness. Its relevance requires assessment of concentration, chemical form, exposure pathways, and evidence of exposure among affected individuals. The detection of leishmaniasis and Kaposi sarcoma in individual patients, suggests that some cases may have had distinct underlying conditions rather than a common disease process.

The identification of *Mycobacteroides abscesses* and *Paraburkholderia fungorum* in the two cases could explain the secondary bacterial infection observed in the cases. *M. abscesses* is usually found in soil and water, and has intrinsic and acquired antimicrobial resistance. This bacteria could easily colonise the wounds and lead to the severe non healing ulcers observed in this investigation (4).

Continues to page 43

The negative findings for anthrax and acid-fast bacilli reduced the likelihood of several suspected infectious causes, while the metagenomic analysis did not identify a pathogen that adequately explained the clinical presentation. However, this negative finding does not exclude infection as the sample type or timing of collection may have affected the results. Overall, the investigation did not identify a single infectious etiology that could explain the clinical manifestations among the eighteen cases.

Study limitation: The recovery of several bacterial species, including *Pseudomonas*, *Citrobacter freundii*, *Klebsiella pneumoniae*, and *Staphylococcus aureus* may represent colonization or environmental contamination rather than the causes of disease. To mitigate this limitation, findings were assessed alongside clinical presentation and antimicrobial susceptibility results, with emphasis on significant resistance patterns such as ESBL production and methicillin resistance.

Conclusion: The systematic multi-platform testing approach excluded high-consequence pathogens. Although no primary etiological agent was identified, AST a guided appropriate treatment of secondary bacterial wound infections and supported antimicrobial stewardship. Establishing a standardized national testing algorithm improves diagnostic efficiency, and supports public health decision-making during outbreaks of unknown aetiology. The detection of ESBL- and selection producing *K. pneumoniae* and methicillin-resistant and β-lactamase-producing *S. aureus* highlights that empirical antimicrobial treatment may increase unnecessary antimicrobial exposure pressure for antimicrobial resistance (AMR) to commonly used antibiotics. We recommend establishment of a standardized national testing algorithm to improve diagnosis, and support public health decision-making during future outbreaks of unknown aetiology.

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

Author contribution: CM led the study conceptualization, data collection, analysis, and article drafting, AA, MN, IM, WS, VN, WO, ST, DK, ADA, SK, DA, MM, SN, AN, SNN, contributed to data collection and writing. SG, GE provided supervision, and article review. All authors read and approved the final manuscript.

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Continues to page 44

Continued from page 43

Strengthening laboratory data utilisation at Kampala Capital City Authority Regional Public Health Emergency Operations Centre during Ebola Bundibugyo Outbreak, Uganda, June 2026

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Summary

Background: Timely laboratory reporting is essential for situational awareness and decision-making during outbreak response. Following confirmation of the Bundibugyo virus disease outbreak in Uganda in May 2026, the national laboratory pillar monitored daily laboratory situation reports (sitreps) submitted through the Outbreak Investigation System (OIS). However, none of the five Kampala Capital City Authority (KCCA) divisions was submitting laboratory sitreps. We assessed barriers to laboratory sitrep reporting and implemented targeted measures to strengthen reporting, coordination, and laboratory data utilisation within KCCA during the outbreak.

Methods: From 15–19 June 2026, we conducted an operational assessment and provided onsite technical support at the KCCA Regional Public Health Emergency Operations Centre. Meetings with Division Laboratory Focal Persons (DLFPs) were used to identify reporting barriers. In collaboration with the Central Public Health Laboratories information technology team, OIS accounts were created for all five DLFPs, followed by training and mentorship on sitrep reporting. A WhatsApp group was established to support communication and reporting, and advocacy was undertaken for designation of a regional laboratory pillar lead. Sitrep submission was subsequently monitored through July 2026.

Results: Before the intervention, none of the five KCCA divisions submitted laboratory sitreps through OIS. Accounts were subsequently created for all five DLFPs. Following the intervention, sitrep submission increased to two reporting divisions. A draft assignment letter for a regional laboratory pillar lead was submitted to the KCCA Incident Management Team. The proposed lead also received mentorship in laboratory data analysis and presentation and subsequently presented one laboratory update to the national laboratory pillar.

Conclusion: Laboratory sitrep submission increased following targeted technical support, although reporting remained incomplete. Establishing functional reporting access, strengthening mentorship and coordination, and formally designating a regional laboratory pillar lead may help sustain timely laboratory reporting and data use across KCCA divisions during outbreak response.

Background

Uganda confirmed an outbreak of Ebola disease caused by Bundibugyo virus in May 2026 following detection of imported cases from the Democratic Republic of the Congo. The outbreak required rapid activation of surveillance, laboratory testing, case management, contact tracing, and coordination mechanisms to support timely detection and response(1,2).

Laboratory systems are central to outbreak response, providing diagnostic confirmation and information required for surveillance and public health decision-making. During the outbreak, the national laboratory pillar coordinated specimen collection, packaging and transport, referral, diagnostic testing, electronic request and result reporting, capacity building, and daily laboratory situation reporting (3,4).

Timely and complete laboratory reporting supports situational awareness, coordination, and evidence-informed decision-making during public health emergencies. The World Health Organization Integrated Disease Surveillance and Response guidelines emphasize timely reporting, verification, analysis, and use of surveillance information for public health action(5) . However, effective electronic reporting may be constrained by limited access to reporting systems, inadequate training, unclear coordination structures, and workforce limitations(3,5–7).

Continues to page 45

Continued from page 44

During national laboratory pillar meetings, it was observed that daily laboratory sitreps were not being submitted from Kampala Capital City Authority through the Outbreak Investigation System. This limited the availability of routine laboratory information for coordination and decision-making. We assessed barriers to laboratory sitrep reporting and implemented targeted measures to strengthen reporting, coordination, and laboratory data utilisation within KCCA during the outbreak.

Methods

Kampala Capital City Authority (KCCA) comprises five administrative divisions: Central, Kawempe, Makindye, Rubaga, and Nakawa. During the Ebola Bundibugyo outbreak, the Kampala Metropolitan Regional Public Health Emergency Operations Centre (EOC) coordinated response activities across these divisions. The EOC's mandate covered surveillance, laboratory reporting, and coordination of public health interventions within all KCCA divisions.

From 15–19 June 2026, we conducted an operational assessment and provided targeted technical support to strengthen laboratory reporting and data utilisation. Entry meetings were held with the Regional Emergency Operations Centre and Division Laboratory Focal Persons (DLFPs) to identify barriers to daily laboratory situation report (sitrep) submission and agree on corrective actions.

In collaboration with the Central Public Health Laboratories information technology team, we implemented interventions to strengthen laboratory reporting: creation of outbreak Investigation System (OIS) accounts and training of all the five DLFPS on daily sitrep submission. Sitreps captured key laboratory-response information, including alerts, specimens collected, results received, turnaround times, availability of laboratory supplies, challenges, and planned actions. A WhatsApp group was established to strengthen communication and coordination between DLFPs and the proposed regional laboratory pillar lead. We also engaged the KCCA Incident Management Team to advocate for formal designation of a regional laboratory pillar lead and provided mentorship to the proposed lead in laboratory data analysis and presentation.

We compared laboratory sitrep submission before and after the intervention and reviewed feedback from DLFPs and the Regional Emergency Operations Centre to identify persistent reporting barriers. Sitrep submission was monitored through July 2026.

The activity was conducted as part of the Ministry of Health public health emergency response under the national laboratory pillar and was reviewed and approved by the Commissioner of Laboratory Services. Data used for the assessment were aggregated laboratory reporting records without patient identifiers. Confidentiality and data security were maintained throughout.

Results

Entry meetings with the Regional Emergency Operations Centre and Division Laboratory Focal Persons (DLFPs) identified several barriers to laboratory sitrep reporting. Although DLFPs had functional Integrated Request and Results Dispatch System (IRRDS) accounts, none had access to the Outbreak Investigation System (OIS). Other identified barriers included absence of a designated regional laboratory focal person, limited access to internet data bundles, competing responsibilities among DLFPs, reporting requirements for information not routinely available within laboratory records, and duplication of reporting across multiple national systems.

OIS accounts were created for all five DLFPs (5/5; 100%), and all five received training on daily sitrep submission. Reporting initially remained delayed because KCCA divisions were configured under Kampala District in OIS and required re-mapping before division-level reporting could begin. By the third week, two of the five divisions were submitting sitreps, increasing submission from 0/5 (0%) to 2/5 (40%).

A WhatsApp group linking DLFPs and the proposed regional laboratory pillar lead was established to support communication, reminders, and troubleshooting. Feedback from participants indicated improved coordination and more rapid resolution of reporting challenges.

Advocacy for regional laboratory leadership resulted in submission of a draft assignment letter for a regional laboratory pillar lead to the KCCA Incident Management Team. The proposed lead also received mentorship in laboratory data analysis and presentation and subsequently presented one laboratory update to the national laboratory pillar.

Continues to page 46

Continued from page 45

Discussion

The findings demonstrate that operational challenges, rather than technical limitations, were the primary barriers to effective laboratory reporting during the KCCA regional Ebola response. Although laboratory focal persons participated in surveillance activities and used other platforms such as Integrated Request and Results Dispatch System (IRRDS), lack of access to the laboratory SitRep system limited their contribution to daily situational reporting. Simple measures, including account creation, user training, and ongoing mentorship, can rapidly improve reporting compliance and data utilization. Increased use of the laboratory SitRep platform following training supports evidence that robust laboratory information systems strengthen situational awareness and emergency response coordination (5). Improved utilization may enhance the timeliness and accuracy of surveillance data, which are essential for evidence-based outbreak response and resource allocation (7).

The absence of a dedicated regional laboratory focal person was a significant gap, affecting coordination and accountability. Similar challenges have been documented in emergency response settings, where clearly defined roles and responsibilities are essential for timely information management and decision-making (6,7). This finding is consistent with evidence from Uganda's PHEOC experience, which emphasizes defined coordination structures and dedicated personnel as critical components of effective emergency response systems (6). Designating a coordinating focal person could strengthen regional laboratory oversight and improve data completeness. Systemic barriers included competing responsibilities, inadequate internet resources, and duplication of reporting across multiple national systems. These factors may contribute to reporting fatigue and compromise data quality and timeliness. Similar findings from outbreak responses in other low- and middle-income countries indicate that multiple reporting platforms and competing responsibilities can reduce data completeness and timeliness (4).

Harmonizing laboratory reporting systems and aligning data requirements with routinely available laboratory records could reduce workload and improve sustainability. These findings also underscore the importance of strengthening laboratory participation in surveillance systems, as recommended by the IDSR framework (3).

Study limitations: This study has several limitations. First, it covered only five divisions within one region over a five□day period, which restricts the generalisability of the findings to other regional Emergency Operations Centres (EOCs) in Uganda. Second, submission was measured as the proportion of divisions submitting sitreps, rather than the completeness or accuracy of the data submitted. A division counted as "submitting" may still have reported inconsistently or with gaps. Third, there was no comparison period or control group, so improvements in reporting cannot be attributed to the intervention with certainty. Fourth, the follow□up period was short, and it is unknown whether the observed 40% submission rate was sustained beyond the immediate support period. These limitations highlight the need for longer□term monitoring, and more rigorous evaluation designs to confirm the effectiveness and sustainability of such interventions.

Conclusion: The creation of OIS user accounts and training of Division Laboratory Focal Persons (DLFPs) improved access to the reporting system and led to submission of daily sitreps by two of five divisions. These findings demonstrate that targeted technical physical support can strengthen laboratory reporting compliance during outbreak response. Sustaining these gains will require formal appointment of a regional laboratory pillar lead, provision of adequate resources, and harmonisation of reporting systems. To strengthen laboratory data reporting within the Kampala Capital City Authority (KCCA) regional Ebola response, it is essential to assign a dedicated regional laboratory focal person who can provide oversight, accountability, and coordination across all divisions. In addition, efforts should be made by the national pillar to harmonise laboratory reporting systems so that duplication is reduced and time spent on multiple platforms is minimised, thereby improving efficiency. Finally, there is a need to review existing systems to ensure that only data routinely available in laboratory records are captured, which will streamline reporting processes and reduce unnecessary workload for Division Laboratory Focal Persons.

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Author contribution: FNM took lead in in supporting the response at KCCA with supervision from GS. All authors GS, WA, and EA. read and approved the final bulletin.

Continues to page 47

Continued from page 46

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Prolonged Laboratory Result Turnaround Time During a Suspected Food Poisoning Outbreak Investigation, Nakaseke District, Uganda, February–March 2026

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Continues to page 48

Continued from page 47

Summary

Background: On 6 February 2026, a food-poisoning event occurred among mourners in Nakaseke district who had travelled to Mukono district. Thirty-eight people developed acute gastrointestinal symptoms, and four were admitted to Ssemuto Health Centre IV. Specimens were referred to an inappropriate laboratory, and results were returned after 23 days, exceeding the recommended 48–72-hour turnaround time by approximately 20 days. We investigated the causes of the prolonged turnaround time in Nakaseke District during February–March 2026.

Methods*:* We conducted a field investigation in 10 of 19 high-volume health facilities in Nakaseke District. Eleven key informant interviews and three focus group discussions involving 27 laboratory personnel were conducted to identify factors contributing to delayed specimen referral and testing. Findings were organized into personnel, process, coordination, and resource domains using a fishbone framework. Potential root causes were prioritized through consensus and used to guide targeted interventions.

Results: Key root causes included absence of test-specific request forms, lack of a specimen-referral register, an inactive district laboratory pillar, and limited awareness of the National referral-laboratory testing capacity. Only four of the 38 symptomatic persons had specimens collected because of shortages of sample-collection materials, and specimens were initially referred using an inappropriate viral haemorrhagic fever request pathway.

Conclusion*:* Weak district laboratory coordination was a major contributor to prolonged turnaround time. Following the investigation, specimens were redirected to the appropriate referral laboratory, and 29 laboratory personnel from the 10 assessed facilities received onsite mentorship on national referral-testing pathways and requirements.

Introduction

Food poisoning is an important public health problem caused by consumption of food or water contaminated with biological, chemical, or toxic agents. Globally, foodborne diseases cause an estimated 600 million illnesses and 420,000 deaths annually. In Uganda, common bacterial causes include *Salmonella*, *Escherichia coli*, and *Shigella* species. [1,2].

On 6 February 2026, 38 mourners from Kaber LC1, Kapeeka Sub-county, Nakaseke District developed diarrhoea, abdominal pain, and vomiting after attending a burial in Mukono District. Four were admitted to Ssemuto Health Centre IV. Specimens were collected but were referred to the Uganda Virus Research Institute using a viral haemorrhagic fever request form rather than the appropriate microbiological and toxicological testing pathway. Laboratory results were returned after 23 days, beyond the expected 48–72-hour turnaround time. We investigated the causes of the prolonged turnaround time and identified opportunities to strengthen specimen referral and laboratory coordination in Nakaseke District February–March 2026.

Methods

We conducted the investigation in Nakaseke district, central Uganda. Of 19 health facilities with laboratory services, 10 high-volume facilities involved in specimen collection and referral during the outbreak were purposively selected. Ssemuto HCIV was the primary care facility, while Ngoma HCIV served as the district specimen-transport hub [3]. We interviewed the District Laboratory Focal Person, laboratory managers, the hub coordinator, and laboratory staff on specimen collection, referral, transportation, documentation, turnaround-time monitoring, and result communication. We also reviewed referral registers, logbooks and case investigation forms, and using a fishbone framework, contributing factors were grouped into personnel, process, coordination, and resource-related causes, and the Five Whys technique was used to explore underlying failures. The Ministry of Health provided administrative clearance, and the U.S. CDC determined the activity to be non-research because it was conducted for public health disease control

Results

Facility-level assessment findings: Across the 10 assessed facilities, 75% of staff were competent in sample management and referral, though 10% of newly recruited staff needed refresher training.

Continues to page 49

Continued from page 48

Case investigation forms were absent, and only 1 facility had a sample referral register. Samples generally followed routine transport to the Hub Coordinator, but delays and inadequate packaging supplies were reported.

Root Cause Analysis Findings: Contributing factors spanned all four RCA domains. Personnel: Ssemuto HCIV staff lacked experience with food poisoning protocols and knowledge of appropriate referral laboratories; staffing shortages were noted at six other facilities. Process: Ssemuto HCIV had no sample register or food-poisoning-specific request forms, prompting improvised use of VHF forms; specimens were sent to UVRI without a specified department instead of CPHL Microbiology or DGAL, with a VHF panel ordered instead of the correct workup, pushing TAT past 72 hours. Co-ordination: The testing laboratory received no advance notification, the District Laboratory Pillar was inactive, no rapid response teams existed, and outbreak information was held informally by individual staff rather than logged. Resources: Collection containers and forms were unavailable, key equipment (refrigerator, microscope) were non-functional, and district-level awareness of national testing capacity was lacking, contributing to specimen misdirection.

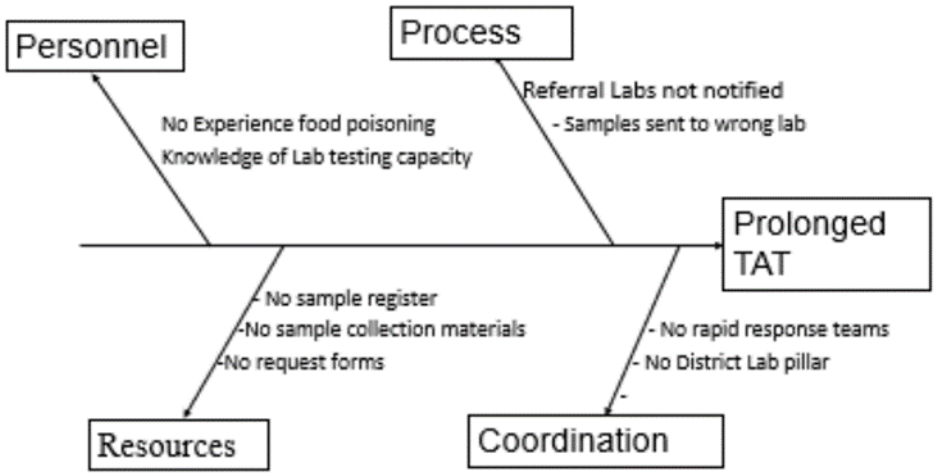


Figure 1. Root cause analysis of prolonged result turnaround time, Nakaseke District, March 2026

Discussion

The investigation identified important weaknesses in specimen collection, referral, and laboratory coordination that contributed to prolonged turnaround time. Only 4 of 38 symptomatic persons had specimens collected because of shortages of collection materials, and the causative agent was not confirmed. Across the assessed facilities, case investigation forms were unavailable and specimen-referral registers were largely absent, indicating broader district-level preparedness gaps [4].

The prolonged turnaround time resulted from combined weaknesses in personnel knowledge, referral processes, coordination, and resources. Specimens were sent to an inappropriate laboratory using the wrong testing pathway, pre-notification was inadequate, and the District Laboratory Pillar was inactive. These findings suggest that the delay reflected systemic laboratory preparedness weaknesses rather than a single isolated error [5].

Study limitations: The assessment also relied partly on staff interviews and incomplete facility records. Because the investigation focused on a single event, the sustainability and long-term effect of the interventions could not be assessed.

Conclusion: Prolonged laboratory turnaround time during the Nakaseke food-poisoning event was driven by gaps in specimen referral, coordination, documentation, staff knowledge, and supplies, with the inactive District Laboratory Pillar identified as a key systemic weakness. . We recommend strengthening capacity across health facilities nationwide through regular mentorship and training on the National Laboratory Guidelines for Outbreak Preparedness and Response, with emphasis on appropriate specimen collection, referral pathways, laboratory pre-notification, and coordination during outbreaks.

Continues to page 50

To sustain timely outbreak response, we recommend establishing a national protocol requiring referral laboratories, including UVRI, CPHL, and DGAL, to routinely communicate turnaround-time information for emergency specimens to district laboratory focal persons and hub coordinators.

Public Health Actions: The district and national laboratory teams initiated corrective actions, including stakeholder engagement, development of a short-term district action plan, emergency procurement of essential specimen-collection supplies, improved referral guidance, and mentorship of 29 laboratory personnel across the 10 assessed facilities.

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

Authors' contribution: MN and MR designed the study and data analysis with guidance from SN, SG and MN. MR, GM, BY did data collection RA, SG participated in bulletin review to ensure scientific integrity and intellectual content. All authors agreed to the submission of the article.

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Completeness of Patient Status Reporting in Integrated Results Reporting and Data System During the Bundibugyo Ebola Outbreak Response, Uganda, May– August 2026

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Summary

Background: Complete patient-status information is essential for monitoring outcomes and supporting case follow-up during outbreak response. During the Bundibugyo Ebola outbreak, declared on 15 May 2026, routine review of the Integrated Results Reporting and Data System (IRRDS) identified a high proportion of records with unknown patient status. On 11 June 2026, national rapid response teams (NRRT) were deployed and initiated targeted follow-up with districts to complete missing patient-status information in IRRDS. We assessed changes in the completeness of patient-status reporting before and after deployment of the NRRTs, May to August 2026.

Methods: A descriptive before-and-after analysis of all routine laboratory surveillance records was conducted in IRRDS. Patient status in IRRDS was categorized as alive, dead, or unknown. The proportion of records with unknown patient status before 11 June 2026 was compared with the proportion after deployment of National rapid response teams between May to August 2026.

Results: A total of 3,429 records were assessed. Before 11 June 2026, 361 of 1,236 records (29.2%, 95% CI: 26.7–31.8) had unknown patient status. Following deployment of the National rapid response teams and initiation of targeted district engagement, 134 of 2,193 records (6.1%, 95% CI: 5.2–7.2) had unknown status. This represented a 23.1% absolute reduction (95% CI: 20.4–25.8) and an approximately 79.1% relative reduction (95% CI: 74.8–82.6%) in unknown-status reporting. The difference in proportions was statistically significant ($\chi^2 = 341.4$, df = 1, $p < 0.001$; two-proportion z-test, $z = 18.5$, $p < 0.001$).

Conclusion: A substantial improvement in completeness of patient-status reporting was observed following deployment of the National rapid response teams and targeted district engagement. Routine identification of incomplete records coupled with active follow-up of reporting districts may strengthen data quality during outbreak response.

Introduction

On 15 May 2026, Uganda declared an outbreak of Bundibugyo Ebola virus disease following confirmation of imported cases from the Democratic Republic of the Congo. Laboratory testing and related patient information were captured in the Integrated Requests and Results Dispatch System (IRRDS), a national electronic platform used to manage laboratory requests and results [1,2,3].

Routine review of IRRDS data during the outbreak identified a high proportion of records with patient vital status recorded as unknown. Because complete patient-status information is important for patient follow-up, mortality surveillance, and interpretation of outbreak data, National rapid response teams (NRRT) were deployed on 11 June 2026 to review incomplete records, engage reporting districts and update patient status in IRRDS.

We assessed changes in the proportion of records with unknown patient status before and after deployment of the NRRTs.

Continues to page 52

Continued from page 51

Methods

We conducted a descriptive before-and-after analysis of routine laboratory surveillance records captured in the Integrated Requests and Results Dispatch System (IRRDS) during the Bundibugyo virus disease outbreak. Data were extracted on 14 August 2026. Integrated Results Reporting and Data System (IRRDS) records were generated from health facilities that initiated specimen requests and four testing laboratories: Central Emergency Response and Surveillance Laboratory, CERSL Wandegeya, Uganda Virus Research Institute Viral Hemorrhagic Fever Laboratory Entebbe, Uganda Virus Research Institute, UVRI Laboratory Arua, and Bwera Mobile Laboratory. The patient-status field analyzed was obtained from laboratory-associated records in IRRDS.

Of 3,483 records in the extracted dataset, 3,429 (98.4%) with a valid sample collection date were included; 54 (1.6%) without a collection date were excluded because they could not be classified by intervention period. Included records had sample collection dates from 6 May to 12 August 2026. Records were checked for duplicates using patient name, sample collection date, district, and health facility; no complete duplicates were identified.

Patient vital status was categorized as alive, dead, or unknown. “Unknown” included records recorded as unknown, not indicated, blank, or otherwise lacking an affirmative alive or dead status. The primary outcome was the proportion of records with unknown patient status.

National rapid response teams were deployed on 11 June 2026 to 58 of the 107 districts referring specimens to the reference testing laboratories. Records were classified as pre-intervention if the sample was collected before 11 June 2026 and post-intervention if collected on or after 11 June 2026. We calculated the number and proportion of records with unknown status in each period, with 95% confidence intervals, and estimated absolute and relative changes between periods. Differences in proportions were assessed using a two-proportion test, with $p<0.05$ considered statistically significant.

The investigation was conducted as part of the Ministry of Health public health response. The Ministry provided administrative clearance, and the U.S. Centers for Disease Control and Prevention determined the activity to be non-research because its primary purpose was public health disease control.

Results

Out of 3,429 records 1,648 (48.1%) were as Alive, 1,286 (37.5%) as Dead, and 495 (14.4%) as Unknown. The National rapid response teams were deployed to 58 of 107 districts referring samples to the testing laboratories. Before 11 June 2026, 361 of 1,236 records (29.2%, 95% CI: 26.7–31.8) had unknown patient status. On or after 11 June 2026, following deployment of the National rapid response teams, 134 of 2,193 records (6.1%, 95% CI: 5.2–7.2) had unknown status, with a 23.1% absolute reduction (95% CI: 20.4–25. 8) and a 79.1% relative reduction (95% CI: 74.8–82.6) in unknown-status reporting. The difference in proportions was statistically significant ($\chi^2 = 341.4$, df = 1, $p < 0.001$; two-proportion z-test, = 18.5, $p < 0.001$).

The post-deployment period included more records (n = 2,193) than the pre-deployment period (n = 1,236).

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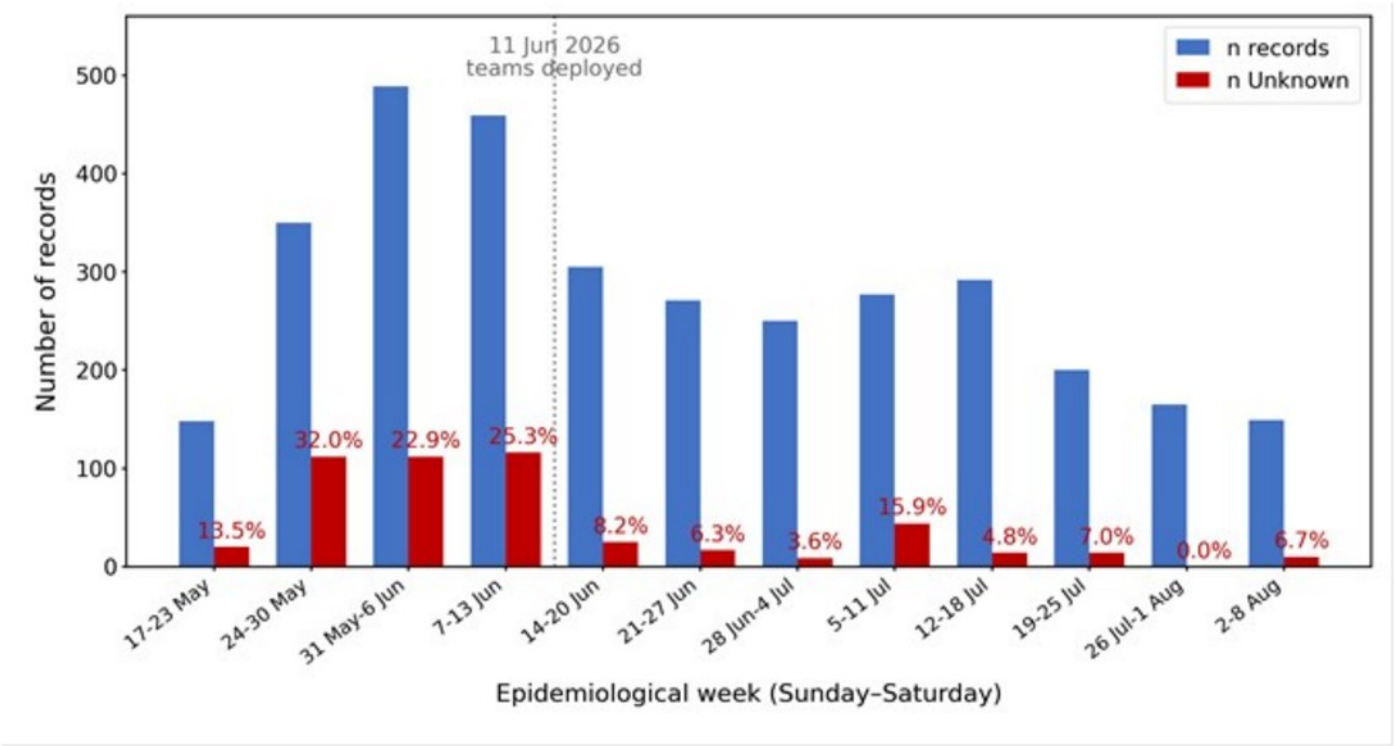


Figure 1: Proportion of laboratory records with unknown patient status, by epidemiological week Uganda, May-August 2026

Discussion

This analysis showed a substantial improvement in completeness of patient-status reporting in IR-RDS following deployment of National rapid response teams and targeted district engagement on 11 June 2026. The proportion of records with unknown patient status declined from 29.2% before deployment to 6.1% afterward, representing a 79% relative reduction. The decline occurred despite a larger number of records in the post-deployment period, suggesting that the improvement was not simply due to lower reporting volume.

Weekly trends were generally consistent with the overall improvement, although a temporary increase in unknown-status reporting was observed during 5–11 July 2026. This suggests that improvements in data completeness may not be sustained automatically and require continued monitoring and follow-up [4]. Unknown status reporting also varied across districts, indicating that some districts experienced more persistent data-quality gaps than others.

Study limitations: Because this was a retrospective before-and-after analysis, the observed improvement cannot be attributed solely to deployment of the National rapid response teams. Other concurrent outbreak-response activities, changes in reporting practices, or differences in sample volume may also have contributed [5]. In addition, classification was based on sample collection date rather than the date on which patient-status records were reviewed or updated, which limits precise attribution of changes to the intervention.

Conclusion: Unknown reporting in IRRDS declined substantially after 11 June 2026, from 29.2% to 6.1%. Although the design does not establish causality, the findings indicate that routine data-quality monitoring combined with targeted district follow-up can contribute to improved completeness of laboratory surveillance data during outbreak response.

Routine data-quality monitoring should be strengthened in IRRDS, with automated identification of incomplete patient-status records and regular feedback to reporting districts. Active follow-up of incomplete records should be incorporated into National rapid response team activities during outbreaks, with additional support directed to districts with persistent reporting gaps.

Continues to page 54

Continued from page 53

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

Authors' contribution: MN, NF designed the study and data analysis with guidance from SN, SG, ARA and PP, CM. KN, FN, NV, MR, AI, CJ, GM, NM, NR, RN did data collection SN. MC and SG participated in bulletin review to ensure scientific integrity and intellectual content. All authors agreed to the submission of the article.

Acknowledgements: We acknowledge the U.S Centers for Disease. and Prevention Uganda through Makerere School of Public Health and Baylor Uganda for technical and implementation support. Their collaboration, expertise and dedication were key in effectively responding to the crisis and protecting public health.

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Developing an Antibiogram to Strengthen Antimicrobial Stewardship at General Military Hospital-Bombo, Uganda, 2024

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Summary

Background: Antimicrobial resistance (AMR) is a major public health challenge in sub-Saharan Africa. Because antimicrobial susceptibility patterns vary across geographic areas and healthcare institutions, local surveillance is essential to guide empiric therapy and antimicrobial stewardship. We established an antibiogram for General Military Hospital Bombo (GMH)in 2024 to characterize local resistance patterns and inform appropriate empiric antibiotic use

Methods: We conducted a hospital-based retrospective study at GMH Bombo using routine clinical microbiology data collected from 1 January to 31 December 2024. Laboratory records of confirmed bacterial isolates with complete antimicrobial susceptibility testing (AST) results were extracted and analyzed using the World Health Organization Network for Antimicrobial Resistance Surveillance Software (WHONET). Following the "first isolate only" principle and Clinical Laboratory Standards Institute (CLSI) M39 guidelines, descriptive analyses were performed to generate a facility-based cumulative antibiogram of antimicrobial susceptibility patterns among clinically significant bacterial isolates.

Continues to page 55

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Results: The antibiogram for GMH-Bombo was successfully developed. *Staphylococcus aureus* (n=98) was the most frequently isolated species, followed by *Escherichia coli* (n=85), *Klebsiella pneumoniae* (n=46), and *Enterococcus* spp. (n=30). The most common specimen types from which these leading isolates were recovered were pus swabs and urine. The most sensitive drugs for *Staphylococcus aureus* were amikacin (100%) and cefuroxime (89%), while the highest resistance was observed to penicillin (5% sensitivity) and azithromycin (10% sensitivity). For *Escherichia coli*, amikacin (100%) and imipenem (97%) showed the highest sensitivity, while ampicillin (2%) and erythromycin (7%) showed the lowest sensitivity. For *Klebsiella pneumoniae*, nitrofurantoin (100%) and Ertapenem (85%) showed the highest sensitivity, while tetracycline (0%) and piperacillin (0%) showed the lowest sensitivity. Finally, for *Enterococcus* spp., cefuroxime (100%) and chloramphenicol (100%) showed the highest sensitivity, while erythromycin (0%) and amoxicillin-clavulanic acid (0%) showed the lowest sensitivity.

Conclusion: The GMH-Bombo antibiogram demonstrated substantial variation in antimicrobial susceptibility and provides locally relevant evidence to guide empiric antibiotic therapy and strengthen antimicrobial stewardship.

Introduction

Antimicrobial resistance (AMR) is a major global public health threat that reduces the effectiveness of antibiotics and contributes to increased morbidity, mortality, and healthcare costs [1,2,3,4,5$6]. In 2019, an estimated 1.27 million deaths globally were directly attributable to bacterial AMR, with sub-Saharan Africa experiencing a disproportionately high burden [7, 8]. Strengthening antimicrobial stewardship (AMS) and using local antimicrobial susceptibility data to guide treatment are therefore important strategies for preserving antibiotic effectiveness [9].

Uganda has established national AMR surveillance and promotes antimicrobial stewardship, including development of facility-specific cumulative antibiograms to guide empirical antibiotic treatment and monitor local resistance patterns [10, 11].

General Military Hospital (GMH)-Bombo is the national referral hospital for the Uganda Peoples' Defence Forces and receives referrals from 105 lower-level UPDF health facilities [12]. Although its microbiology laboratory has conducted culture and antimicrobial susceptibility testing since 2012, the hospital had not developed a cumulative antibiogram. We developed a cumulative antibiogram using bacterial isolates from GMH-Bombo to describe local antimicrobial susceptibility patterns, inform empirical antibiotic selection, and strengthen antimicrobial stewardship.

Methods

We conducted a hospital-based retrospective analysis of routine microbiology data collected at General Military Hospital (GMH)-Bombo, the national referral hospital for the Uganda Peoples' Defence Forces, from 1 January to 31 December 2024. GMH-Bombo is the only UPDF facility that routinely performs bacterial culture and antimicrobial susceptibility testing and receives referrals from UPDF health facilities across Uganda.

Data were abstracted from microbiology laboratory registers and included patient characteristics, specimen type, bacterial species isolated, antibiotics tested, and antimicrobial susceptibility results. We included confirmed bacterial isolates with complete susceptibility results and adequate documentation; fungal isolates were excluded. To minimize duplication, only the first isolate of a given bacterial species from each patient during the study period was included.

Continues to page 56

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Data were cleaned in Microsoft Excel and analyzed using World Health Organization Network for Antimicrobial Resistance Surveillance Software (WHONET) version 2025. A cumulative antibiogram was developed in accordance with Clinical and Laboratory Standards Institute M39 guidance, and only bacterial species with at least 30 isolates were included. Antimicrobial susceptibility was summarized as the percentage of isolates susceptible to each antibiotic, with isolate counts reported as frequencies.

Administrative clearance to conduct the study and access the hospital was granted by ministry of Health of Uganda through the office of Director General of Health Services. Additional authorization was obtained from the leadership of GMH-Bombo to access clinical microbiology data. The activity was reviewed by the U.S. Centers for Disease Control and Prevention and determined not to constitute research. It was implemented in accordance with applicable U.S. federal laws and CDC policies, including 45 C.F.R. part 46.102(l)(2), 21 C.F.R. part 56, 42 U.S.C. §241(d), 5 U.S.C. §552a, and 44 U.S.C. §3501 et seq

Results

A total of 331 bacterial isolates representing 14 species were recovered during the study period. Of these, 259 (78%) isolates from four species met the CLSI M39 criteria for inclusion in the cumulative antibiogram: *Staphylococcus aureus* (n=98), *Escherichia coli* (n=85), *Klebsiella pneumoniae* (n=46), and *Enterococcus* spp. (n=30).

Staphylococcus aureus

Among 98 *Staphylococcus aureus* isolates, susceptibility was highest to linezolid (89%), chloramphenicol (86%), and nitrofurantoin (76%). Susceptibility was 69% to clindamycin, 58% to gentamicin, and 45% to ciprofloxacin. Lower susceptibility was observed to tetracycline (36%), ceftazidime and cefoxitin (33% each), erythromycin (27%), cefepime (25%), cotrimoxazole (23%), amoxicillin-clavulanic acid (17%), ampicillin (13%), and penicillin G (5%) (Table 1).

Escherichia coli

Among 85 *Escherichia coli* isolates, susceptibility was 100% to amikacin and tetracycline, 97% to imipenem, 93% to meropenem, and 84% to ertapenem. Susceptibility was 78% to chloramphenicol, 75% to nitrofurantoin, 67% to piperacillin, 66% to gentamicin, and 63% to cefepime. Lower susceptibility was recorded for ciprofloxacin (30%), ceftazidime (20%), ceftriaxone (17%), cefotaxime and cefuroxime (13% each), amoxicillin-clavulanic acid (9%), cotrimoxazole (7%), and ampicillin (2%) (Table 2).

Klebsiella pneumoniae

Among 46 *Klebsiella pneumoniae* isolates, susceptibility was highest to nitrofurantoin (100%), ertapenem (85%), meropenem (83%), and imipenem (81%). Susceptibility was 67% to amikacin, 59% to gentamicin, 57% to cefepime, 54% to chloramphenicol, and 53% to amoxicillin-clavulanic acid. Susceptibility was lower to ciprofloxacin (42%), ceftriaxone (28%), cefoxitin (25%), ceftazidime (10%), and cefotaxime and cefuroxime (9% each). No susceptibility was recorded to ampicillin, piperacillin, or tetracycline (Table 3).

Enterococcus spp.

Among 30 *Enterococcus* spp. isolates, susceptibility was 100% to chloramphenicol, linezolid, nitrofurantoin, and amikacin. Susceptibility was 58% to amoxicillin-clavulanic acid, 57% to vancomycin, and 50% to gentamicin and ampicillin. No susceptibility was recorded to ciprofloxacin, erythromycin, or cotrimoxazole (Table 4).

Continues to page 57

Continued from page 56

Overall susceptibility pattern

Across the four bacterial species, susceptibility varied widely by antibiotic. Several antibiotics had susceptibility below 40%, while the highest susceptibility values were observed for selected antibiotics including linezolid, chloramphenicol, nitrofurantoin, amikacin, and carbapenems (Table 5).

Table 1: Antibiogram for Staphylococcus aureus (n = 98)

Antibiotic	Sensitivity%
Linezolid(30µg)	89
Chloramphenicol(5µg)	86
Nitrofurantoin(300µg)	76
Clindamycin(2µg)	69
Gentamicin(10µg)	58
Ciprofloxacin(5µg)	45
Tetracycline(30µg)	36
Ceftazidime(30µg)	33
Cefoxitin(30µg)	33
Erythromycin(15µg)	27
Cefepime(30µg)	25
Cotrimoxazole (1.25/23.5µg)	23
Amoxycillin-clavulanic acid(20/10µg)	17
Ampicillin(10µg)	13
Penicillin G(10 units)	5

Table 2: Antibiogram for Escherichia coli (n=85)

Antibiotic	Sensitivity
Amikacin(30µg)	100
Tetracycline(30µg)	100
Imipenem(10µg)	97
Meropenem(10µg)	93
Ertapenem(1g)	84
Chloramphenicol(5µg)	78
Nitrofurantoin(300µg)	75
Piperacillin(100µg)	67
Gentamicin(10µg)	66
Cefepime(30µg)	63
Ciprofloxacin(5µg)	30
Ceftazidime(30µg)	20
Ceftriaxone(30µg)	17
Cefotaxime(30µg)	13
Cefuroxime(Oral),(30µg)	13
Amoxycillin-clavulanic acid(20/10µg)	9
Cotrimoxazole (1.25/23.5µg)	7
Ampicillin(10µg)	2

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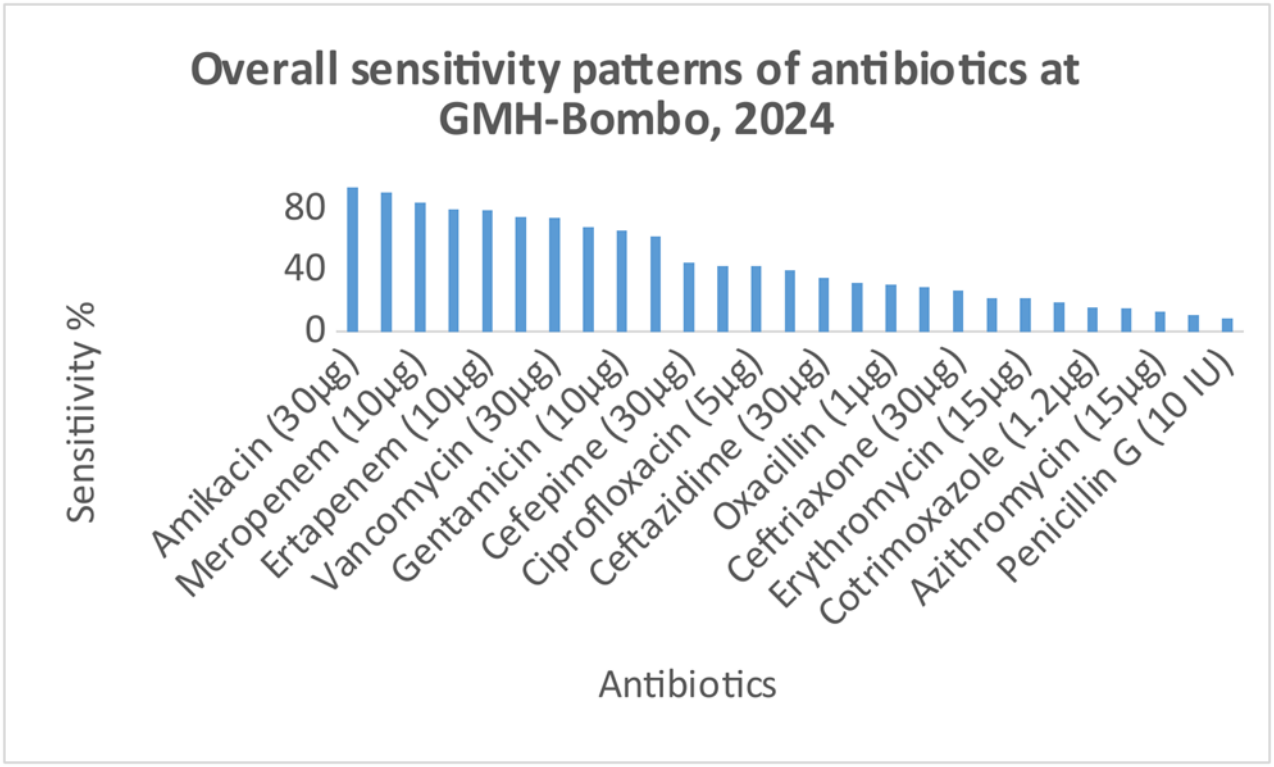
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Table 3: Antibiogram for Klebsiella Pneumoniae (n=46)	
Antibiotic	Sensitivity%
Nitrofurantoin(300µg)	100
Ertapenem(1g)	85
Meropenem(10µg)	83
Imipenem(10µg)	81
Amikacin(30µg)	67
Gentamicin(10µg)	59
Cefepime(30µg)	57
Chloramphenicol(5µg)	54
Amoxycillin-clavulanic acid(20/10µg)	53
Ciprofloxacin(5µg)	42
Ceftriaxone(30µg)	28
Cefoxitin(30µg)	25
Ceftazidime(30µg)	10
Cefotaxime(30µg)	9
Cefuroxime(Oral),(30µg)	9
Ampicillin(10µg)	0
Piperacillin(100µg)	0
Tetracycline(30µg)	0

Table 4: Antibiogram for Enterococcus spp (n = 30)	
Antibiotic	Sensitivity%
Chloramphenicol(5µg)	100
Linezolid(30µg)	100
Nitrofurantoin(300µg)	100
Amikacin(30µg)	100
Amoxycillin-clavulanic acid(20/10µg)	58
Vancomycin(30µg)	57
Gentamicin(10µg)	50
Ampicillin(10µg)	50
Ciprofloxacin(5µg)	0
Erythromycin(15µg)	0
Cotrimoxazole (1.25/23.5µg)	0

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Continued from page 58



Discussion

The GMH-Bombo antibiogram showed substantial resistance to several commonly used antibiotics. *Staphylococcus aureus, Escherichia coli, Klebsiella pneumoniae,* and *Enterococcus* spp. were the most frequently isolated organisms. Susceptibility to several commonly used agents, including ampicillin, penicillin, azithromycin, amoxicillin-clavulanate, and ceftriaxone, was low, limiting their usefulness for empirical treatment.

Resistance was particularly notable among *E. coli* and *K. pneumoniae*, while reduced susceptibility was also observed to selected last-line agents, including carbapenems and vancomycin. These findings highlight the need for continued antimicrobial resistance surveillance and strengthened antimicrobial stewardship to preserve the effectiveness of available treatment options. The cumulative antibiogram provides facility-specific evidence that can support empirical antibiotic selection and guide stewardship interventions at GMH-Bombo.

Study limitation: Only organisms with at least 30 isolates were included in the cumulative antibiogram in accordance with CLSI M39 guidance. Consequently, less frequently isolated organisms, including some with extensive drug resistance, were not presented and may represent clinically important resistance patterns requiring separate review.

Conclusion: The GMH-Bombo antibiogram demonstrated high resistance to several routinely used antibiotics, with reduced susceptibility observed among important bacterial pathogens. Facility-specific antibiograms can support empirical treatment decisions and strengthen antimicrobial stewardship. GMH-Bombo and other facilities with microbiology capacity should routinely develop and use cumulative antibiograms to guide empirical treatment. These data should be incorporated into antimicrobial stewardship activities, hospital treatment guidelines, and national AMR surveillance systems. Clinicians should also be encouraged to use culture and susceptibility results whenever available, particularly for severe or difficult-to-treat infections.

Conflict of Interest: The authors declare no conflict of interest

Author contribution: MRN lead in project developing, data collection, analysis and initial draft, writing. AEO gave permission for access to raw data and field supervision, JN supervised the write-up, SG, and RM.

Continues to page 60

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Changing patterns of drug-resistant tuberculosis notifications in Uganda: findings from routine surveillance, 2015–2024

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Summary

Background: Drug-resistant tuberculosis (DR-TB) remains an important challenge for tuberculosis control in Uganda. We analysed national DR-TB surveillance data from 2015–2024 to describe temporal tends in DR-TB case-notifications and geographic patterns that could inform programming.

Methods: We analysed confirmed rifampicin-resistant tuberculosis (RR-TB), multidrug-resistant tuberculosis (MDR-TB), and extensively drug-resistant tuberculosis (XDR-TB) cases reported through the District Health Information Software 2 (DHIS2) between 2015 and 2024. We assessed trends using the Mann–Kendall test and examined geographic clustering using Local Indicators of Spatial Association.

Results: We identified 5,294 DR-TB cases, including 4,050 (76%) RR-TB, 1,184 (22%) MDR-TB, and 60 (1%) XDR-TB cases. National case-notification rates increased from 0.36 per 100,000 population in 2015 to 1.11 per 100,000 in 2024, with a decline during 2020–2021. Notifications increased significantly among new patients (p=0.012), while the increase among previously treated patients was not significant (p=0.15). District-level analysis, restricted to 2022–2024, showed marked geographic variation. Kampala, Wakiso, and Mukono demonstrated persistent high-high spatial clustering, while Kotido, Karenga, Moroto, and Nabilatuk showed recurrent but non-persistent clustering.

Conclusion: These findings indicate geographic differences in DR-TB notification patterns and highlight the value of using routine surveillance data to guide targeted case finding, diagnostic services, and surveillance strengthening.

Background

Uganda remains among countries with a high tuberculosis (TB) burden, with drug-resistant TB (DR-TB) posing additional challenges for diagnosis, treatment, and prevention. Uganda is also among the countries identified by the World Health Organization (WHO) as having a high burden of multidrug-resistant or rifampicin-resistant TB (MDR/RR-TB). The WHO estimates indicate that approximately 2,000 people develop MDR/RR-TB in Uganda annually yet in 2023 only 1,200 cases were registed nationally, illustrating the gap between the estimated burden and the number detected through routine notification systems[1]. Expansion of molecular testing, drug-susceptibility testing, and decentralized DR-TB services has increased opportunities to identify resistant disease [1-3].

Routine surveillance data can provide more than national counts. Examining notification patterns over time and across geographic areas can identify locations where DR-TB is repeatedly detected and where additional public-health attention may be warranted. We described changes in case-notification rates and identified geographic patterns, Uganda, 2015-2024, to inform TB programming.

Methods

We conducted a retrospective analysis of routinely reported DR-TB surveillance data from all National Tuberculosis and Leprosy Program-affiliated DR-TB sites in Uganda between 2015 and 2024. We used cases recorded in DHIS2 and analysed them according to the resistance category recorded in the database: rifampicin-resistant TB (RR-TB), multidrug-resistant TB (MDR-TB), or extensively drug-resistant TB (XDR-TB).

Continues to page 62

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We calculated annual DR-TB case-notification rates per 100,000 population using mid-year population estimates. We assessed trends using the Mann–Kendall test, and estimated annual change using Sen's slope.

We assessed geographic patterns at regional and district levels. At regional level, we summarised DR-TB notifications for 2015–2024. Because consistent district-of-residence information was available only from 2022 onward, district-level analyses were restricted to 2022–2024. We applied Empirical Bayes smoothing to reduce instability in rates from sparsely populated districts, and used Local Indicators of Spatial Association (LISA) to identify spatial clustering.

We sought permission to use the routinely generated program data from the Uganda Ministry of Health, the National Tuberculosis and Leprosy Program. In addition, The US Centers for Disease Control and Prevention (CDC) provided the non-research determination (NRD) for non-human subjects. In This activity was reviewed by the US CDC and was conducted consistent with applicable federal law and CDC policy. §§See, e.g., 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

Results

Trends in drug-resistant tuberculosis case-notifications, Uganda, 2015-2024

Between 2015 and 2024, 5,294 DR-TB cases were reported. Rifampicin resistant-TB accounted for 4,050 (76%) cases, MDR-TB for 1,184 (22%), and XDR-TB for 60 (1%). Among the 2,806 cases with individual-level information, 1,886 (67%) were male and the median age was 39 years (IQR 28–50). Overall, 1,842 (66%) reported cases were HIV-positive.

National DR-TB case-notification rates increased from 0.36 per 100,000 population in 2015 to 1.11 per 100,000 in 2024 (Figure 1). Notifications increased during 2015–2019, declined during 2020–2021, and subsequently increased again.

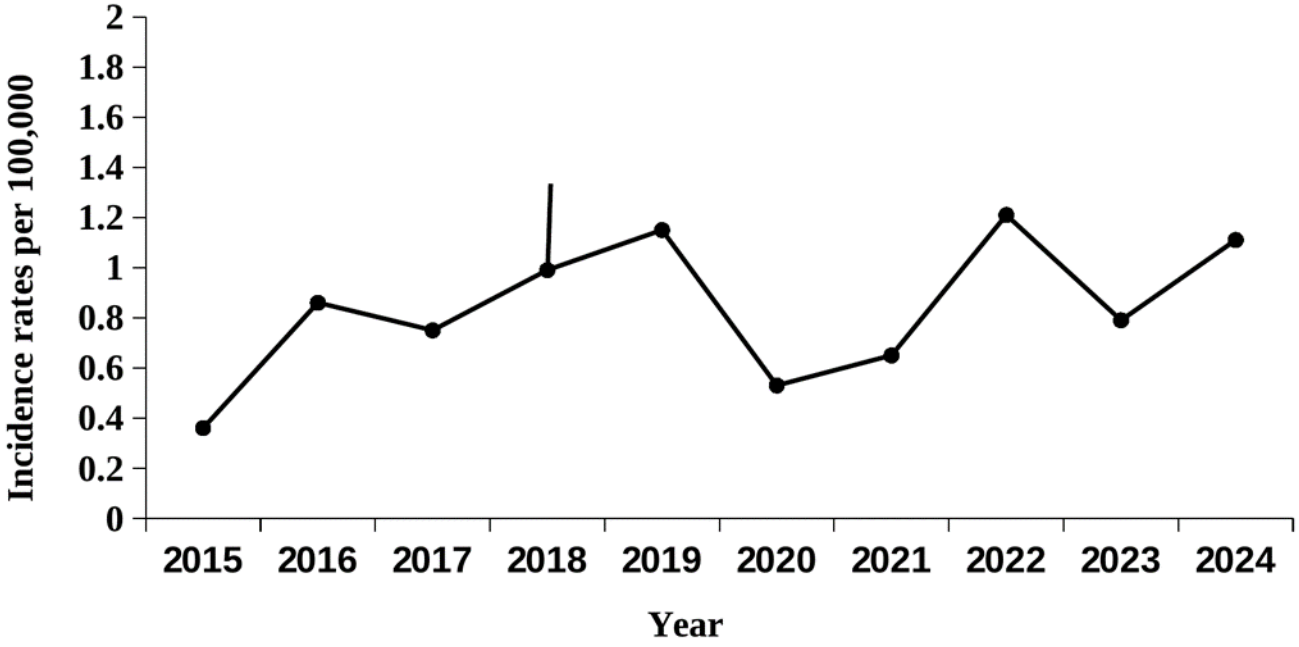


Figure 1:Trends in case-notifications of drug resistance tuberculosis, Uganda, 2015-2024

When categorized by treatment history, notifications increased among both new and previously treated patients. The increase among new patients was statistically significant (Sen's slope 43; 95% CI=11.4–102; p=0.012), whereas the increase among previously treated patients was not statistically significant (Sen's slope 15 cases per year; 95% CI =3.8–40.3; p=0.152) (Figure 2).

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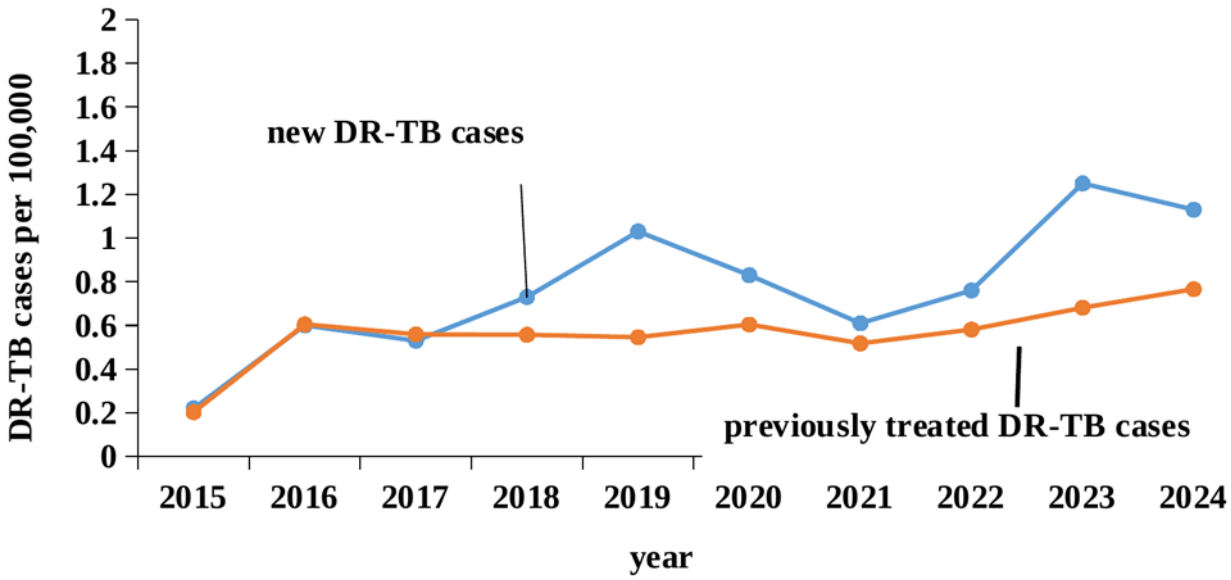


Figure 2: Trends in drug resistant tuberculosis cases among new cases and previously treated cases, Uganda, 2015-2024

Geographic pattern drug resistant-tuberculosis case notifications, Uganda, 2022–2024

Geographic analysis showed substantial variation in DR-TB case-notification rates. At regional level, higher notification rates were repeatedly observed in Kampala, Lango, and Karamoja (Figure 3).

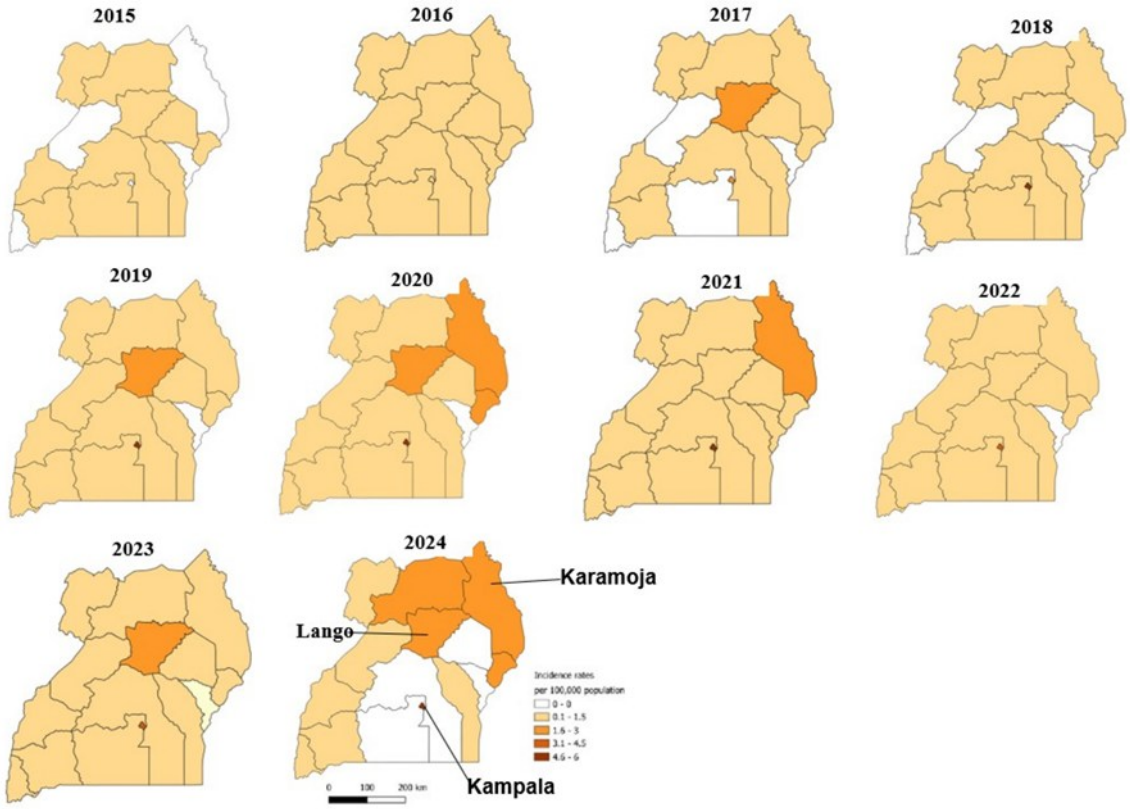


Figure 3: Rifampicin resistant/multidrug resistant tuberculosis case-notifications per 100,000 population, Uganda 2015–2024

At district-level, Kampala, Wakiso, and Mukono had elevated notifications across multiple quarters. Karenga, Kotido, Moroto, and Nabilatuk also frequently appeared in higher notification categories. After smoothing, LISA identified persistent high-high clustering in Kampala, Wakiso, and Mukono. Kotido, Karenga, Moroto, and Nabilatuk demonstrated recurrent but non-persistent clustering.

Continues to page 64

Continued from page 63

Discussion

Drug-resistant tuberculosis notifications in Uganda increased overall between 2015 and 2024, with a decline during 2020–2021 followed by renewed increases. Notifications increased significantly among new patients, while the increase among previously treated patients was not statistically significant. Geographic patterns also varied across the country, with persistent high-high clustering observed in Kampala, Wakiso, and Mukono and recurrent but non-persistent clustering observed in several districts of Karamoja.

The increase in notifications among new patients is also important for the TB programme. Surveillance data cannot determine whether this pattern represents community transmission, increased detection, reactivation, or other factors. Nevertheless, it supports maintaining attention to early detection and contact investigation in addition to management of patients with previous TB treatment.

The reduction in notifications during 2020–2021, followed by recovery illustrates how surveillance can be affected by disruptions in health services [4, 5].

The geographic concentration of notifications should be interpreted in relation to the availability and use of diagnostic and treatment services. Previous studies in Uganda have documented geographic differences in TB burden and access to health services [6, 7]. However, the present analysis did not include measures of diagnostic access, testing coverage, or service availability, so we cannot determine whether areas with higher notifications had better access to DR-TB diagnosis and treatment. Higher notification rates may reflect differences in underlying burden, detection, diagnostic access, reporting, or a combination of these factors. Conversely, lower notification rates should not automatically be interpreted as evidence of lower DR-TB burden where diagnosis or reporting may be limited.

Study limitations: This analysis used routinely reported surveillance data, may be affected by incomplete reporting, reporting delays, which could underestimate notifications in districts with weaker reporting systems. Differences in access to diagnostic services and changes in surveillance coverage over time may also have resulted in fewer cases being detected in some areas, potentially exaggerating or reducing apparent geographic difference. District-level geographic analysis was limited to 2022–2024 because consistently available information on district of residence was not available for earlier years. Individual-level variables were also incomplete for some notified cases. In addition, the analysis was descriptive and ecological; therefore, observed temporal or geographic patterns cannot be used to establish causal relationships or determine whether increases in notifications represent changes in underlying DR-TB transmission.

Conclusion: Drug resistant tuberculosis case-notifications in Uganda increased overall from 2015 to 2024 with a significant increase among new patients and substantial geographic variation in notification patterns. Persistent high clustering was observed in Kampala, Wakiso, and Mukono, while several districts in Karamoja showed recurrent but non-persistent clustering. These findings demonstrate the value of routine surveillance for identifying geographic and temporal signals that can inform program planning. Strengthening geographically targeted case-finding, expanding timely drug-resistance testing, integrating DR-TB and HIV services, and improving surveillance in underserved districts may be important for reducing inequities and accelerating progress toward TB control.

Acknowledgements: We acknowledge the Ministry of Health for granting permission to access the National Tuberculosis and Leprosy Program. We also thank the United States Centers for Disease Control and Prevention (US CDC) for supporting the Uganda Public Health Fellowship Program activities.

Author contributions: DA took lead in conceptualizing the study idea, data collection, data analysis, bulletin article writing and editing. RM, BK, GA, RA supervised the investigation, and reviewed the bulletin article. All the authors read and approved the final article.

Conflict of interests: The authors declare no competing interests.

Continues to page 65

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Malaria Diagnostic Utilization Across Health Facility Levels in Uganda: Analysis of Routine District Health Information System 2 Data, 2024-2025

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Summary

Background: WHO recommends parasitological confirmation of suspected malaria using microscopy or mRDTs. In Uganda, microscopy is expected at higher-level facilities, while mRDTs predominate at lower-level facilities. Workload, equipment, and availability may influence diagnostic practices. Study compared utilization by level and ownership..

Methods: We conducted a retrospective descriptive analysis of malaria diagnostic data (HMIS 105) reported by Health Centre III, Health Centre IV, regional referral hospitals, and national referral hospitals between January 2024 and December 2025. Facilities were classified by level, ownership (government, private not□for□profit, private for□profit), region, and district. We calculated utilisation as the proportion of total malaria tests performed by each method and compared results across facility characteristics and years using chi□square tests.

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Results: A total of 26,457,810 malaria diagnostic tests were reported in 2024 and 26,769,816 tests in 2025.Nationally, mRDTs accounted for most testing (79.7% in 2024; 80.2% in 2025), while microscopy declined slightly (20.3% to 19.8). Reliance on mRDTs was highest at Health Centre III and IV, whereas Regional Referral Hospitals showed increasing microscopy use. By ownership, government facilities relied most on mRDTs (85.6 in 2024 and 86.1% in 2025), private-for-profit facilities made the greatest use of microscopy (58.2 in 2024 and 58.8%in 2025), and private not-for-profit facilities fell between (37.5 in 2024 and 39.8% microscopy in 2025). Malaria diagnostic utilization varied across regions and districts, and in both years, mRDT utilization was generally highest in Northern and Western districts, while several Central districts, including Kampala and Masaka, reported comparatively lower mRDT utilization and greater microscopy use.

Conclusion: Malaria diagnosis in Uganda remained heavily dependent on mRDTs, with substantial variation across facility levels and ownership categories. mRDTs predominated at HC III and HC IV facilities, while microscopy was more frequently utilized in referral and private facilities.

Background

Malaria remains a major cause of morbidity and mortality in Uganda, accounting for a substantial proportion of outpatient visits, hospital admissions, and inpatient deaths. Children under five years of age bear a particularly high burden, with increased risk of severe disease and death. Despite progress in malaria control and improvements in laboratory systems, malaria remains a priority communicable disease in Uganda. Accurate diagnosis is essential for appropriate case management, rational use of antimalarial medicines, and reduction of malaria-related morbidity and mortality (1).

Uganda's Malaria Reduction and Elimination Strategic Plan (2021–2025) emphasizes parasite-based diagnosis as a core component of malaria case management, consistent with World Health Organization recommendations for parasitological confirmation of suspected malaria cases. Microscopy and malaria rapid diagnostic tests (mRDTs) are the two main methods used for malaria diagnosis. Microscopy allows detection of malaria parasites, species identification, and parasite quantification, which can be important in the assessment of severe disease and monitoring of treatment response. mRDTs provide rapid parasitological confirmation but may have limitations in detecting non-*Plasmodium falciparum* infections when tests target only *P. falciparum*-specific antigens (2–4) .

Malaria diagnostic capacity varies across levels of the health system. Health Centre III facilities and higher-level facilities are expected to have microscopy capacity, while lower-level facilities may rely predominantly on mRDTs. Uganda's health system comprises government, private not-for-profit, and private for-profit facilities, which contribute routine malaria service data through the District Health Information Software 2 (DHIS2) platform (5–7).

Despite national and global recommendations on parasite-based diagnosis, utilisation of malaria diagnostic methods may vary across health facilities. Factors such as availability of trained laboratory personnel, quality-assurance systems, diagnostic commodity stock-outs, laboratory infrastructure, and facility capacity can influence which diagnostic methods are used. However, routine national-level evidence describing how microscopy and mRDTs are utilised across different health-facility levels and ownership categories remains limited. Understanding these patterns is important for identifying gaps in diagnostic capacity and informing the allocation of laboratory resources, commodities, and quality-improvement interventions(5,6).

Routine DHIS2 data provide an opportunity to examine malaria diagnostic utilisation across the health system without additional patient-level data collection. We assessed the utilisation of recommended malaria diagnostic methods microscopy and mRDTs across health-facility levels and ownership categories in Uganda using routine DHIS2 data from 2024 to 2025.

Methods

We conducted a retrospective descriptive study using routinely collected malaria surveillance data reported through Uganda's District Health Information Software 2 (DHIS2) from January 2024 to December 2025. The analysis included 2,164 Health Centre IIIs, 295 Health Centre IVs, 16 Regional Referral Hospitals, and 9 National Referral Hospitals reporting malaria diagnostic data. Facilities were classified by ownership, region, and district.

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Continued from page 66

Data were extracted from routine HMIS 105 reports and included numbers of malaria tests performed by microscopy and malaria rapid diagnostic tests (mRDTs), facility level and ownership, district, region, month, and year. Data were reviewed for completeness, consistency, and implausible values before analysis.

Diagnostic utilisation was defined as the proportion of all malaria diagnostic tests performed using microscopy or mRDTs. Total malaria tests were calculated as the sum of microscopy and mRDT tests. Utilisation was assessed nationally and compared by facility level, ownership, region, district, month, and year.

Descriptive statistics were used to summarize diagnostic utilisation. The study used routinely collected, aggregated DHIS2 surveillance data with no individual patient identifiers. The analysis was conducted as part of Ministry of Health malaria surveillance and programme-monitoring activities, with confidentiality and data security maintained throughout.

Results

Overall Malaria Diagnostic Testing Volume, Uganda, 2024-205

A total of 26,457,810 malaria tests were reported in 2024 and 26,769,816 tests in 2025. The total number of reported malaria tests increased slightly between the two years.

Malaria diagnostic utilization, Uganda, 2024-2025

mRDTs were the dominant malaria diagnostic method nationally in both years. mRDT utilization increased from 79.7% in 2024 to 80.2% in 2025, while microscopy utilization declined from 20.3% to 19.8% (Figure 1).

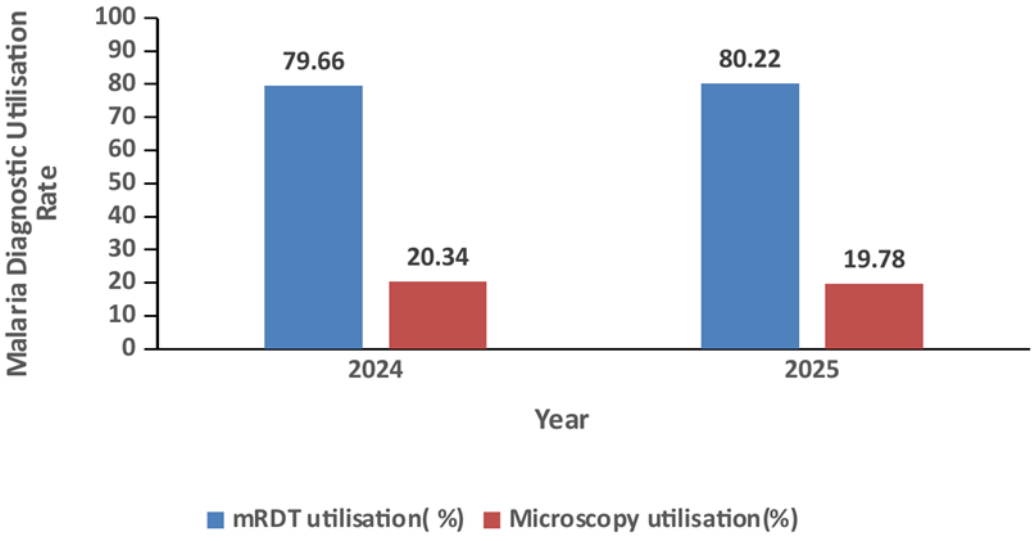


Figure 1: National malaria diagnostic utilisation rates, 2024–2025

Malaria diagnostic utilization by health facility level, Uganda, 2024-2025

Between 2024 and 2025, malaria diagnostic utilization among patients tested at various health facility levels across Uganda revealed distinct patterns. At Health Centre III, mRDTs accounted for 83.9% of malaria tests in 2024 and 84.6% in 2025. Similarly, Health Centre IV facilities maintained high utiilisation on mRDTs, with 70.5% in 2024 and 70.78% in 2025. In contrast, Regional Referral Hospitals, demonstrated a shift toward microscopy, increasing from 47.7% in 2024 to 52.9% in 2025 (Figure 2)

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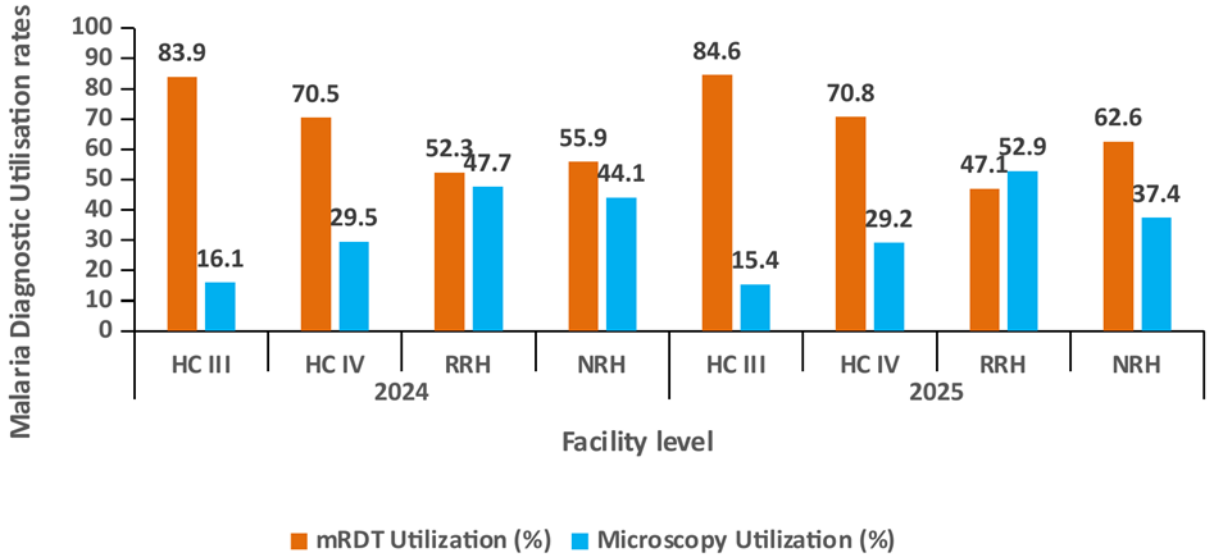


Figure 2: Malaria diagnostic utilisation by facility level, Uganda, 2024–2025

Malaria diagnostic utilisation by facility ownership, Uganda, 2024–2025

Between 2024 and 2025, malaria diagnostic utilization among patients tested in Uganda's health facilities of different ownership categories showed clear contrasts. In government facilities, mRDTs accounted for 85.6% of malaria tests in 2024 and 86.1% in 2025, In contrast, private for profit facilities, malaria microscopy was the highest with 58.2% in 2024 and 58.8% in 2025. Private not for profit facilities, showed intermediate microscopy utilization, rising from 37.5% in 2024 to 39.8% in 2025 (Figure 3).

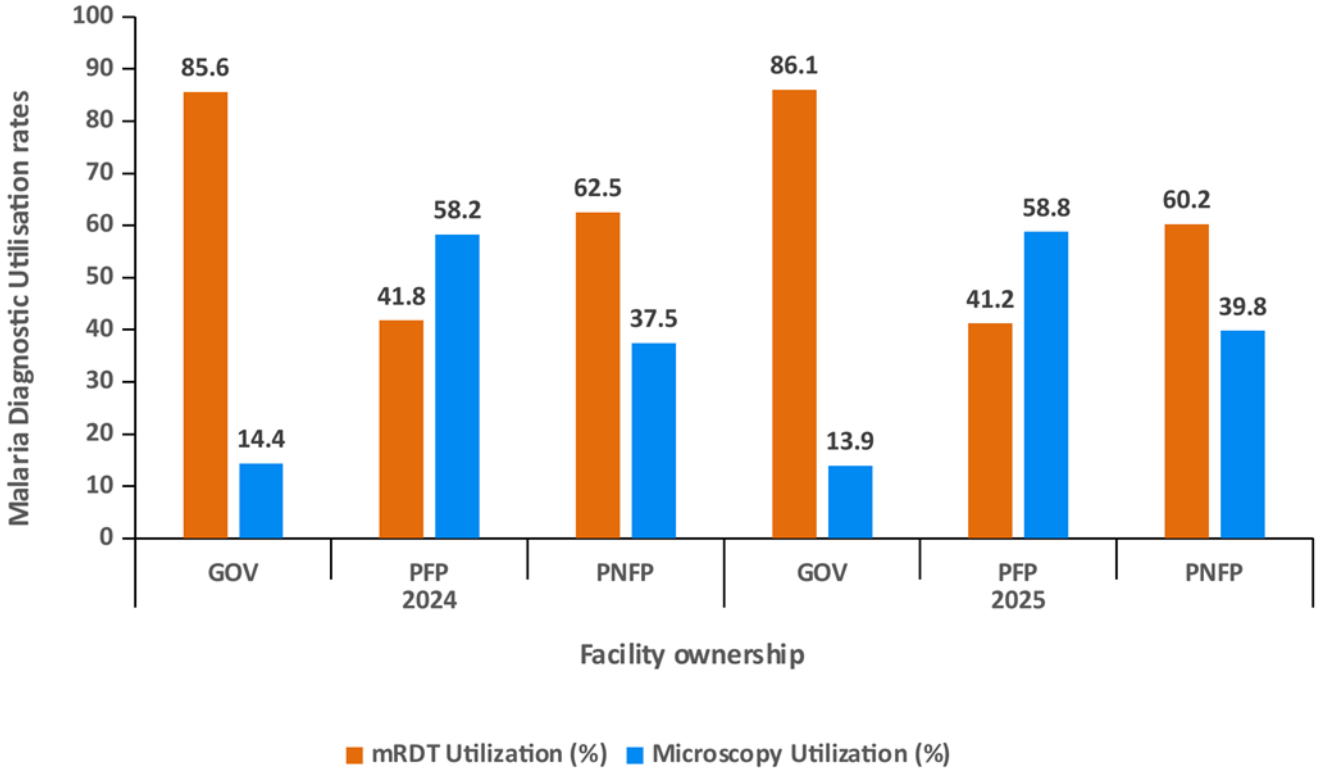


Figure 3: Malaria diagnostic utilisation by facility ownership, Uganda, 2024–2025

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Regional utilisation of malaria diagnostics, Uganda, 2024-2025

In 2024 and 2025, malaria diagnostic practices among patients tested across Uganda's districts and health facilities were dominated by Rapid Diagnostic Tests (mRDTs), though regional and facility level disparities was notable. Northern and Western Uganda consistently reported the highest mRDTs utilisation (>80%), while Eastern Uganda showed moderately high uptake (>75%). In Central Uganda's urban districts (Kampala, Masaka, Rakai), mRDT use was lower (50–70%), Microscopy utilisation varied widely in 2024, districts such as Mubende, Fort Portal, and Mbarara recorded the highest uptake (>40%), while many rural districts remained below 30%. In 2025, microscopy remained significant in some districts (e.g., Ibanda, Mubende, Mbarara, Masaka, Kampala, all >45%), moderate in others (e.g., Rukungiri, Gulu ≈40%), and very low in places like Kabarole (<20%) (Figure 4).

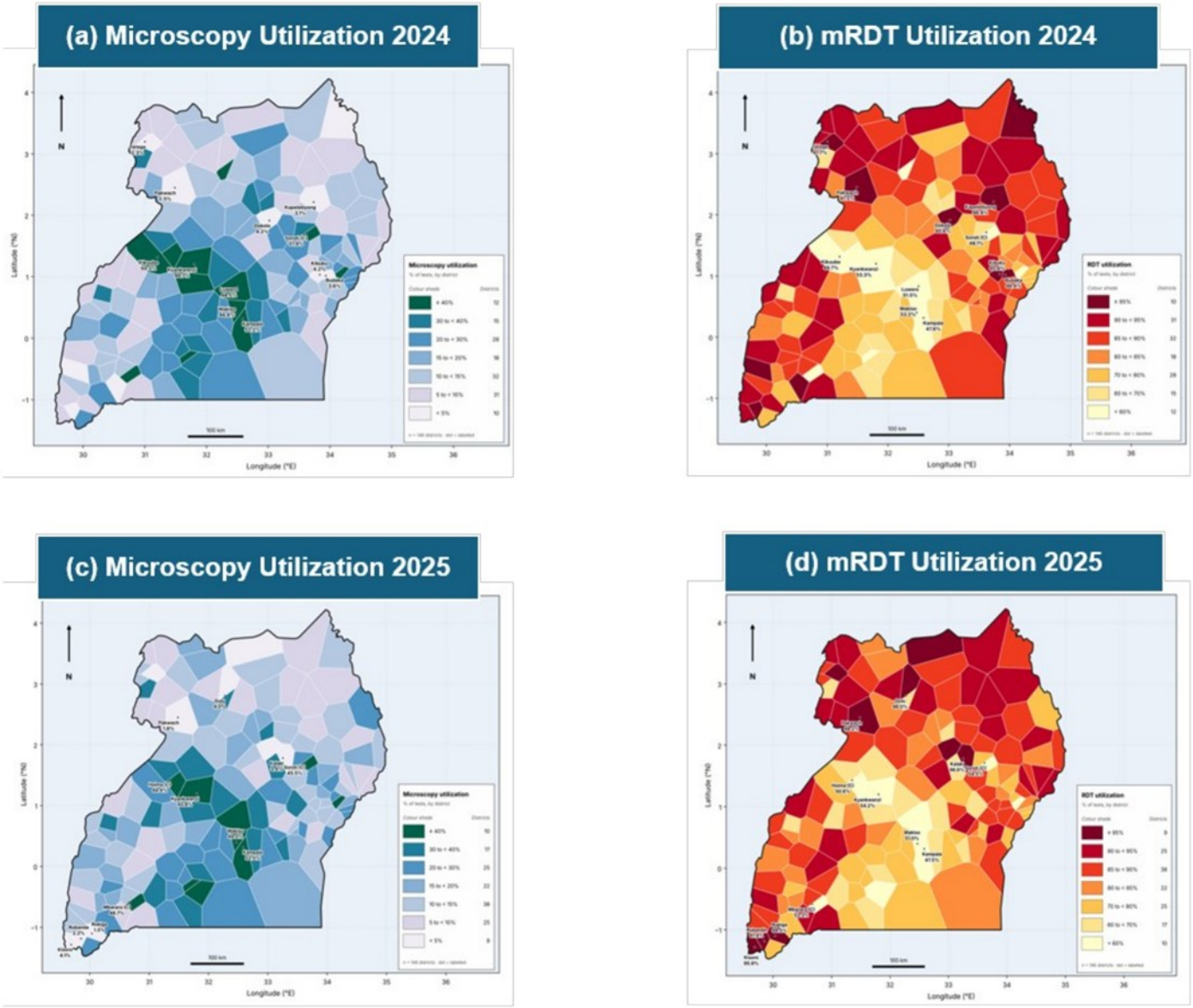


Figure 4. District-level utilization of malaria diagnostic methods in Uganda, 2024-2025. (a) Microscopy utilization, 2024; (b) mRDT utilization, 2024; (c) Microscopy utilization, 2025; and (d) mRDT utilization, 2025 Source: HMIS 105/DHIS2.

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Discussion

Analysis of DHIS2 data from 2024–2025 showed that mRDTs remained the predominant malaria diagnostic method in Uganda, accounting for about four in five reported tests. Their greater use, particularly at lower-level facilities, likely reflects their accessibility and ease of use where laboratory capacity is limited. Increased mRDT use in 2025 alongside declining microscopy use indicates continued reliance on rapid testing despite national guidance supporting complementary use of microscopy(5–8).

Diagnostic utilization varied by facility level and ownership. Health Centre III and IV facilities relied more on mRDTs, while Regional Referral Hospitals reported greater microscopy use, consistent with stronger laboratory capacity. Government facilities used mRDTs more frequently, whereas private-for-profit facilities reported greater microscopy use. These differences may reflect variation in laboratory capacity, staffing, equipment, supplies, and service delivery(5,6).

Regional differences were also evident, with higher mRDT use in Northern and Western Uganda and lower use in parts of Central Uganda, including Kampala and Masaka. These findings demonstrate the value of DHIS2 diagnostic-utilization indicators for identifying areas requiring further assessment and targeted laboratory support(9).

Study limitations: The analysis relied on routinely reported DHIS2 data and was therefore subject to reporting completeness and accuracy. Aggregated data limited assessment of patient-level characteristics and outcomes. In addition, the analysis describes diagnostic utilization but cannot determine why a particular method was used or establish causal relationships with equipment, staffing, supplies, or workload. Operational assessments are therefore needed to better understand the observed patterns.

Conclusion: Malaria RDTs dominated malaria diagnosis in Uganda during 2024–2025, accounting for approximately four in five reported tests. Utilization varied substantially by facility level, ownership, and region, with particularly high mRDT reliance at Health Centre III and IV facilities and greater microscopy use at Regional Referral Hospitals and private-for-profit facilities. Routine DHIS2 diagnostic-utilization indicators can help identify gaps and guide targeted strengthening of malaria diagnostic services.

Microscopy capacity should be strengthened at facilities where it is expected to be available through functional equipment, adequate supplies, competent staff, maintenance, and quality assurance. Routine DHIS2 indicators should be used to identify facilities with unusually high mRDT reliance or low microscopy utilization for targeted supportive supervision. Where microscopy capacity exists but use remains low, staffing, workload, and workflow constraints should be assessed. Government, PNFP, and PFP facilities should all be included in diagnostic-strengthening efforts, while targeted operational assessments should investigate the reasons for low microscopy utilization and guide corrective action.

Conflict of Interest: The authors declare no conflict of interest
Author contribution: FNM took lead in conceptualizing the project, data abstraction, analysis and original draft writing. All authors GS, AW, and EA read and approved the final draft.
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Trends and distribution of zoonotic disease-related mortality, Uganda, 2020–2025

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Summary

Background: Uganda is a recognised zoonotic hotspot and has invested heavily since 2017 in detecting priority zoonoses through the District Health Information Software 2 (DHIS2). Whether that investment has been matched by fewer deaths is unknown, and national totals conceal which pathogens account for the deaths that remain and where they occur. We described zoonotic disease-related deaths reported through DHIS2 in Uganda during 2020–2025, and their distribution by pathogen, health facility level, and region .

Methods: We analyzed all cases and deaths for the nine zoonoses reportable through DHIS2 during 2020–2025, grouped as rabies; anthrax and brucellosis; other zoonoses; and viral haemorrhagic fevers (VHFs). We excluded any facility-condition-year death count that both exceeded 100 deaths and exceeded the total reported for that condition at all other facilities nationally in the same year. We calculated proportional mortality and mortality rate per 100,000 population, and tested annual death counts for monotonic trend using the Mann–Kendall test (Kendall's tau-b).

Continues to page 72

Continued from page 71

Results: Of 344,998 zoonotic disease cases reported, 1,894 (0.5%) resulted in death. Annual deaths held between 392 and 460 from 2020 to 2023, then fell by 68% in a single year to 126 in 2024 and to 94 in 2025; because the fall was a step rather than a slope, the trend across all 6 years did not reach significance (τb=−0.73, p=0.056). Anthrax and brucellosis, the only category to decline progressively, fell from 283 deaths in 2020 to 16 in 2025 (τb=−0.87, p=0.017), whereas rabies showed no evidence of a monotonic trend (τb=−0.07, p=1.0) and rose from 10.6% (43/405) to 36% (34/94) of annual deaths. Brucellosis alone caused 680 (36%) of the 1,894 deaths. Health Centre (HC) II–HC IV facilities and private clinics reported 1,713 (90%) of deaths but approximately 272,500 (79%) of cases.

Conclusion: Reported zoonotic deaths fell by 77% over 6 years, but as a single step between 2023 and 2024 rather than a progressive decline, a shape more consistent with a change in reporting than with improving survival. Only the bacterial zoonoses declined progressively; rabies showed no evidence of decline and now accounts for more than a third of a much smaller burden. Nine in ten deaths were reported at the first point of contact rather than at referral hospitals, placing both the diagnostic gap and the opportunity to close it at HC II–HC IV facilities and private clinics. Triangulating these data against medically certified deaths would establish whether the decline is real before it is read as programme success.

Background

Zoonotic diseases account for more than 60% of emerging infectious diseases worldwide and involve over 2—known pathogens transmissible between animals and humans (1) . Sub-Saharan Africa carries a disproportionate burden: outbreaks in the region rose by 63% between 2012 and 2022 compared with the previous decade, and such events comprise approximately 33% of all public health emergencies there (2, 3). Uganda is a recognised hotspot, with extensive wildlife-livestock-human interfaces and a livestock-dependent rural economy that includes 14.5 million cattle, 17.4 million goats, 7.1 million pigs, and 57.8 million poultry (4), and experienced recurrent outbreaks of priority zoonoses during 2020-2025, including Ebola disease caused by Sudan virus, Marburg virus disease, Rift valley fever, anthrax and Crimean-Congo haemorrhagic fever (5, 6).

Uganda has invested substantially in the systems that detect these events; the electronic Integrated Disease Surveillance and Response module has been embedded within DHIS2 since 2017 and was scaled nationally during 2020–2022, and the country adopted the 7-1-7 target for rapid detection, notification, and response and the National One Health Platform has institutionalized multisectoral coordination. Whether these investments have translated into fewer deaths has not been described, and aggregate figures conceal both which pathogens account for the deaths that remain and where in the health system they occur, which determines whether the appropriate response is community-level prevention, primary care capacity, or referral-level treatment. We described zoonotic disease-related deaths reported through DHIS2 in Uganda during 2020–2025, and their distribution by pathogen, health facility level, and region, to inform targeted action under the National One Health Strategic Plan, the Third National Development Plan (7) and Sustainable Development Goal 3 (8).

Methods

We conducted a descriptive analysis of routinely collected national DHIS2 surveillance data from public and private health facilities in Uganda during 2020–2025. We included nine reportable zoonotic conditions and grouped them into four categories: rabies; anthrax and brucellosis; other zoonoses; and viral haemorrhagic fevers.

Facility-level information was obtained from the national master facility list, and population denominators from Uganda Bureau of Statistics projections. We screened facility–condition–year records for implausible death counts and excluded 8,973 of 10,867 reported deaths that met predefined inconsistency criteria, retaining 1,894 deaths for analysis.

We calculated proportional mortality, mortality rates per 100,000 population, and deaths as a percentage of reported cases. Annual trends were assessed using the Mann–Kendall test, with $p<0.05$ considered statistically significant; given the six annual observations, trend results were interpreted cautiously. Data were analyzed in Stata version 17.

The analysis used aggregated routine surveillance data and was conducted with Ministry of Health permission and U.S. CDC non-research determination.

Continues to page 73

Continued from page 72

Results

Of 344,998 zoonotic disease cases reported through DHIS2 during 2020–2025, 1,894 (0.5%) resulted in death. Annual deaths were stable across the first four years at 405 in 2020, 460 in 2021, 417 in 2022, and 392 in 2023, then fell by 68% in a single year to 126 in 2024 and to 94 in 2025 (Table 1, Figure 1A). Mean annual deaths were 419 during 2020–2023 and 110 during 2024–2025. Because the series was flat before this step and low afterwards rather than falling progressively, the Mann–Kendall test across all 6 years did not reach significance ($\tau b = -0.73$, $p = 0.056$), despite a fall of 77% between the first and last year.

Only anthrax and brucellosis declined progressively, from 283 deaths in 2020 to 16 in 2025 ($\tau b = -0.87$, $p = 0.017$). Each of the other three series contained an interior peak, for which the Mann–Kendall test is not an appropriate summary: other zoonoses peaked at 270 deaths in 2021, rabies at 88 in 2023, and VHFs at 10 in 2022. Because the categories declined at different rates, the composition of mortality shifted (Figure 1B): anthrax and brucellosis accounted for 70% of deaths in 2020 but 17% in 2025, while the rabies share rose from 11% to 36%. Across the whole period, anthrax and brucellosis accounted for 806 deaths (43%) and other zoonoses for 804 (42%), an essentially equal contribution differing by two deaths, with rabies accounting for 267 (14%) and VHFs for 17 (0.9%). Brucellosis alone accounted for 680 deaths (36%), more than anthrax, plague, human African trypanosomiasis, and the VHFs combined.

Deaths were overwhelmingly reported at the lower levels of the health system (Figure 1C). Of 1,894 deaths, private clinics reported 637 (34%), HC III 592 (31.3%), HC II 361 (19%), general hospitals 131 (6.9%), HC IV 123 (6.5%), regional referral hospitals 47 (2.5%), and the national referral hospital 3 (0.2%). Together, HC II–HC IV facilities and private clinics reported 1,713 deaths (90%) but approximately 272,500 (79%) of the 344,998 cases, a concentration present in every year, from 72% of deaths in 2020 to between 92% and 99% thereafter. Geographically, rabies mortality moved from

Kampala, which recorded 6.4 deaths per 100,000 population in 2020 and none from 2023 onwards, to Karamoja, which recorded the highest regional rate in 2023 (2.0 per 100,000) and 2025 (1.4) (Figure 2A–C). Anthrax and brucellosis mortality was highest in Karamoja throughout, peaking at 7.8 per 100,000 in 2020, before every region fell below 0.5 per 100,000 by 2025 (Figure 2D–F).

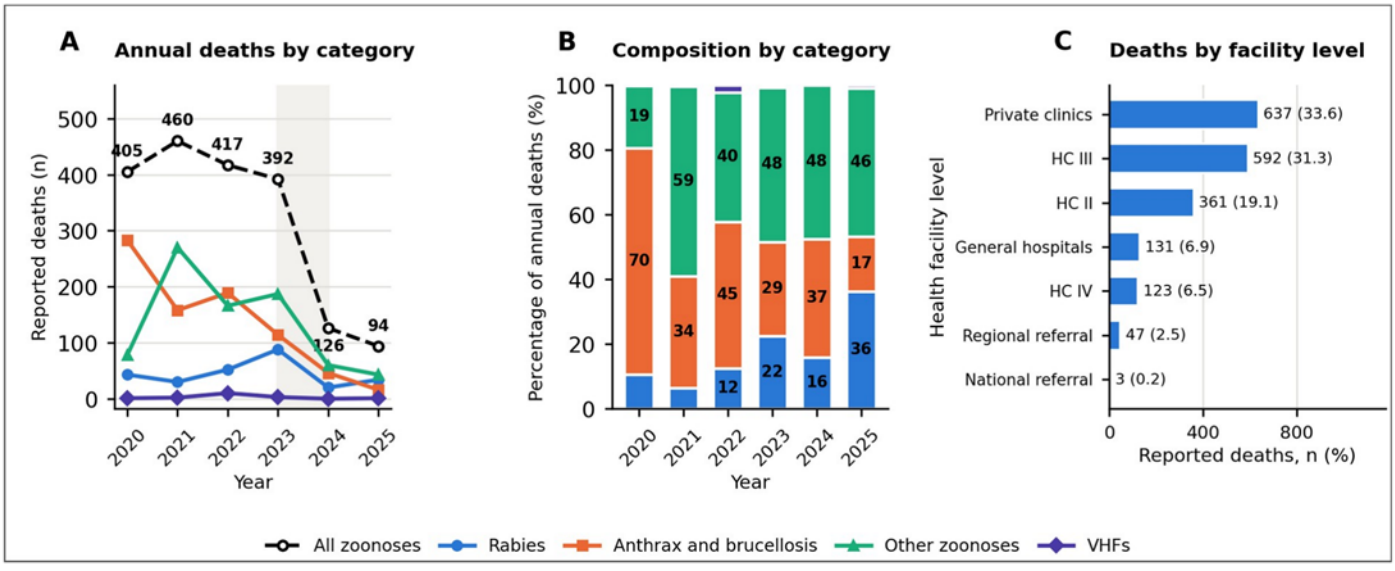


Figure 1: Annual zoonotic disease-related deaths by disease category (A), the percentage composition of those deaths by category (B), and deaths by health facility level (C), Uganda, 2020–2025. Values in panel C are deaths (proportional mortality, %). HC, health centre; VHFs, viral haemorrhagic fevers

Continues to page 74

Continued from page 73

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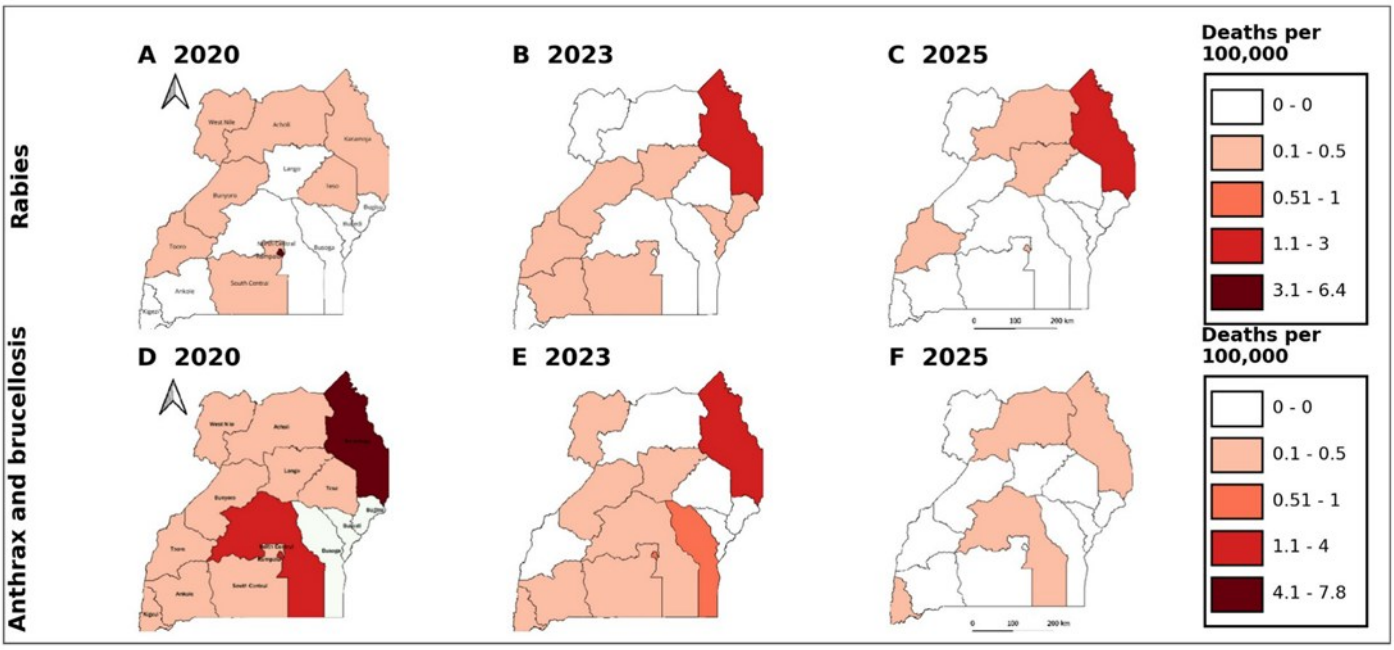


Figure 2: Mortality rate per 100,000 population from rabies (A–C) and from anthrax and brucellosis (D–F), by region, Uganda, 2020, 2023, and 2025

Table 1: Zoonotic disease-related deaths reported through DHIS2, by specific zoonosis, disease category, and year, with Mann–Kendall trend test results, Uganda, 2020–2025

Disease category and	2020	2021	2022	2023	2024	2025	Total	%	τb	p-value
Rabies (animal bites, sus-	43	30	52	88	20	34	267	14	−0.07	1.0
Anthrax and brucellosis	283	158	189	114	46	16	806	43	−0.87	0.017
Brucellosis	282	133	125	98	37	5	680	36		
Anthrax	1	25	64	16	9	11	126	6.7		
Other zoonoses	78	270	166	187	60	43	804	42	−0.47	0.27
Influenza-like illness	31	148	92	75	47	10	403	21		
Human influenza, new subtype	16	65	41	32	8	0	162	8.6		
Plague	23	25	8	40	5	25	126	6.7		
Human African trypanoso- miasis	8	32	25	40	0	8	113	6.0		
Viral haemorrhagic fevers	1	2	10	3	0	1	17	0.90	−0.14	0.70
Crimean-Congo haemor-	1	1	9	3	0	1	15	0.79		
Marburg virus disease	0	1	1	0	0	0	2	0.11		
All zoonoses	405	460	417	392	126	94	1,894	100	−0.73	0.056

Continues to page 75

Continued from page 74

%, proportional mortality, calculated as deaths in the group divided by all 1,894 zoonotic deaths; τb, Kendall's tau-b for the trend in annual deaths, reported for disease categories and for all zoonoses combined; a negative value indicates a declining trend. The rabies, other zoonoses, VHF, and all-zoonoses series each contain an interior peak and are not monotonic, so their non-significant p-values indicate that a monotonic trend was not demonstrated rather than that no change occurred.

Discussion

Reported zoonotic mortality in Uganda fell sharply over 6 years, but neither gradually nor uniformly across pathogens. The fall occurred as a discontinuity between 2023 and 2024 rather than as the gradual accumulation expected if strengthened surveillance, diagnosis, and case management were improving survival. Changes in reporting practice, indicator definitions, or reporting completeness can produce exactly this pattern, and the electronic Integrated Disease Surveillance and Response module was itself being scaled and reconfigured over this period (8), so the decline is best read as a decline in reported deaths. Analysis of neonatal sepsis mortality in Uganda over the same years found that only 8.8% of DHIS2-reported deaths were medically certified (9); the same triangulation would show whether the 2024 discontinuity appears in both systems, supporting a true decline, or in DHIS2 alone, pointing to a reporting artefact.

The divergence between pathogens is consistent with the differing reach of available control measures. Anthrax and brucellosis are acquired from livestock and are amenable to animal-sector interventions such as livestock vaccination, safe slaughter, and control of trade in sick animals (10-12). Rabies is prevented instead by timely post-exposure prophylaxis and dog vaccination, which depend on continuous supply and coverage rather than on outbreak response (13, 14); that rabies deaths did not fall while other categories did means it now constitutes a larger share of a smaller burden. Brucellosis, a chronic condition that generates no outbreak response and little programmatic visibility, produced more deaths over the period than anthrax, plague, human African trypanosomiasis, and the VHFs combined, and its mortality burden merits attention proportionate to its ranking among Uganda's priority zoonoses (10).

That nine in ten deaths were reported at HC II–HC IV facilities and private clinics, which handled a smaller share of cases, is the most directly actionable finding, and it was stable in every year. This is compatible with community-acquired infection presenting late to the nearest facility, where diagnostic capacity and referral linkages are weakest (15, 16), although severity-based referral with death before transfer could produce the same pattern. Either way, the level of care at which these deaths are recorded is the level at which they must be averted. Both rabies and bacterial zoonoses persisted longest in Karamoja, consistent with its pastoralist livelihoods, livestock density, and distance from referral care (12, 17).

Study limitations: Passive surveillance under-reports, most at lower-level facilities and in remote districts, so these counts understate the true burden and the concentration of deaths at HC II–HC IV level would be greater still if reporting were complete. Changes in reporting completeness would also alter measured deaths in the absence of any true change, which is why the 2024 discontinuity cannot be attributed to improved survival on these data alone. With only six annual observations the Mann–Kendall test has low power, so non-significant results are not evidence that no change occurred. The exclusion rule removed 82.6% of raw reported deaths; applying the stated numeric criterion alone leaves 2,123 deaths, a monotonic series and a significant overall trend ($\tau b = -1.00$, $p = 0.003$), but leaves every pathogen-specific finding unchanged. Deaths under the animal bites indicator are suspected rather than laboratory-confirmed rabies, influenza-like illness includes non-zoonotic influenza, and case counts by facility level were available only as rounded percentages.

Conclusion: Zoonotic disease-related deaths reported through DHIS2 fell from 405 in 2020 to 94 in 2025, but as a step change between 2023 and 2024 rather than a progressive decline, and cannot be attributed to improved survival on these data alone. Anthrax and brucellosis accounted for the only progressive decline, while rabies showed no evidence of decline and now represents more than a third of the reported burden. Brucellosis was the single largest cause of zoonotic death, and nine in ten deaths were reported at the first point of contact

Continues to page 76

Continued from page 75

Triangulating DHIS2 zoonotic mortality with medically certified deaths could establish whether the 2023–2024 discontinuity reflects a true decline or a change in reporting, before the trend is used for programme evaluation. Sustained rabies control, through reliable post-exposure prophylaxis stocks at primary care facilities and dog vaccination in regions with persistent mortality, could reduce the one category that has not responded to date, and giving brucellosis programmatic attention proportionate to its mortality burden could address the largest single contributor identified here. Building capacity for early recognition, diagnosis, and referral at HC II–HC IV facilities and private clinics, and adding validation rules that prevent deaths from exceeding cases at the point of data entry, could reduce both the deaths occurring at first contact and the entry errors found in this extract.

Conflict of interest: The authors declare no conflict of interest

Authors' contributions: JW conceptualized the study, led data collection, analysis, and interpretation and wrote the draft article. RM and BK reviewed the draft and made multiple edits for intellectual content. WN, AN, MDN, CN, LB, and ARA reviewed the article for intellectual content and scientific integrity. All authors read and approved the final article.

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Continues to page 77

Continued from page 76

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Effect of digital viral load requests on viral load turnaround time trends in Rwenzori Region, Uganda, 2024–2025: an interrupted time series analysis

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Summary

Background: Timely viral load (VL) results are essential for monitoring antiretroviral therapy and optimizing patient care. Paper-based VL request can delay sample processing because they require duplicate data entry and are prone to illegible information. On April 7, 2025, digital VL requests through Uganda EMR and extended Laboratory Information Management System (LIMS) were rolled out in Rwenzori Region but their effect was unknown. We assessed the effect of digital VL requests on Turnaround Time (TAT) between June 2024 and July 2025.

Methods: We abstracted VL data from the Central Public Health Laboratory (CPHL) dashboard for one hospital, six health centre (HC) IVs, and 18 HC IIIs in one city and four districts between June 2024 and July 2025. We defined TAT as duration in days from sample collection to facility results reception. We computed weekly median TAT by district. We defined the study period as pre-(June 1, 2024–April 6, 2025) and post-(April 7, 2025–July 15, 2025) digital VL request rollout. We conducted interrupted time series analysis using autoregressive integrated moving average models with the appropriate (p,d,q) specification determined separately for each district and the overall region to determine the effect of digital VL requests on TAT.

Results: Of the 5,168 VL records in the post-digital, 3,317 (64%) were digital VL requests of which 3,201 (97%) were through UgandaEMR. Median TAT for digital (35, IQR:25–45) and paper-based (36, IQR:25–49) VL requests was significantly different. Median TAT was 17 (IQR: 12–24) pre-digital, 36 (IQR: 25–47) post-digital and 20 (IQR=14–30) days overall

Continues to page 78

Continued from page 77

Median TAT increased significantly pre-digital period overall [slope=0.4 (p<0.01)]. Digital VL rollout increased TAT immediately overall [27.7 days (p<0.01)], then a significant decline in the post-digital trend overall [slope-change=-3.0 (p<0.01)] and across all districts. Reductions in TAT were highest in Kabarole [slope-change=-3.6 (p<0.01)] and lowest in Bunyangabu.

Conclusion: Digital VL requests were associated with an initial increase in TAT followed by a significant downward trend. However, TAT was comparable between digital and paper based requests which suggested that the improvement was not attributable to digital VL requests alone. We recommend rollout of digital VL request countrywide.

Introduction

The World Health Organization recommends viral load (VL) testing as the preferred method for monitoring antiretroviral therapy (ART) response among people living with HIV and confirming treatment failure (1). Timely return of VL results is important for clinical decision-making, including adherence counselling and regimen switching, with a commonly used turnaround-time target of 14 days from sample collection to receipt of results at the healthcare facility (1–3).

In Uganda, VL testing is largely centralized, requiring samples to move through multiple steps from healthcare facilities to testing laboratories and results back to facilities (4,5). Paper-based VL requests can contribute to delays through incomplete or illegible information, data-entry errors, and difficulties linking samples to patient records (6,7).

To strengthen VL sample tracking and reporting, the Ministry of Health introduced digital VL request systems linked to UgandaEMR and the Laboratory Information Management System, together with barcode-based sample identification. In April 2025, barcode-linked VL testing was rolled out in Fort Portal City and Bundibugyo, Bunyangabu, Kabarole, and Ntoroko districts in Rwenzori Region, where VL turnaround time exceeded the 14-day target (3) with an average of 17 days. We assessed the effect of digital VL requests on VL TAT at selected healthcare facilities in Rwenzori Region during June 2024–July 2025.

Methods

We conducted an interrupted time series study using routinely collected viral load (VL) programme data from 25 public ART-providing health facilities in Fort Portal City and Bundibugyo, Bunyangabu, Kabarole, and Ntoroko districts, Rwenzori Region, western Uganda, from 1 June 2024 to 15 July 2025. The facilities included one general hospital, six Health Centre IVs, and 18 Health Centre IIIs, all using UgandaEMR version 4.0.3 or higher with internet-enabled VL health information exchange.

In April 2025, facilities transitioned from paper-based VL request slips to digital VL requests using barcodes through UgandaEMR or extended LIMS. The barcode uniquely linked each specimen to the corresponding patient and request record and enabled electronic retrieval of requests and synchronization of results.

We extracted VL programme data from the national VL dashboard and triangulated these with UgandaEMR data. Variables included district, hub, request type, request platform, sample collection date, laboratory receipt date, test date, and result-printing date. VL turnaround time (TAT) was defined as the number of days from sample collection to receipt of results at the health facility, using the hub result-printing date as a proxy for result receipt.

Data were aggregated into 60 weekly observations and divided into pre-digital (1 June 2024–6 April 2025) and post-digital (7 April–15 July 2025) periods. We used autoregressive integrated moving average (ARIMA) models to estimate the immediate level change and post-intervention trend change in weekly median VL TAT following rollout of digital VL requests. Models were selected using stationarity assessment, autocorrelation diagnostics, and Akaike information criterion. In the post-digital period, median TAT for paper-based and digital requests was compared using the Mann–Whitney U test.

Continues to page 79

Continued from page 78

Results

Characteristics of Viral Load Program Data by Digital Viral Load Request Period in Rwenzori Region, Uganda, 2024–2025.

Between 1 June 2024 and 15 July 2025, 21,502 VL samples were collected from the 25 healthcare facilities. Of these, 5,793 (27%) were from Kabarole, 5,436 (25%) from Bunyangabu, 4,829 (22%) from Fort Portal City, 3,089 (14%) from Bundibugyo and 2,355 (11%) from Ntoroko. The majority of samples (21001, 98%) were referred to CPHL.

Most samples were from HC IIIs, 12,345 (57%), followed by HC IVs, 7,664 (36%), and the general hospital, 1,493 (7%). Overall, 18,117 (84%) VL requests were paper-based and 3,317 (16%) were digital requests. Among digital requests, 3,201 (97%) were made through UgandaEMR and 117 (3%) through extended LIMS (Table 1).

Table 1: Characteristics of Viral Load Program Data by Digital Viral Load Request Period in Rwenzori Region, Uganda, 2024–2025

Variable	Overall N=21,502 n(%)	Pre-digital VL requests N=16,334 n (%)	Post-digital VL requests N=5,168 n (%)
District			
	3089 (14.4)	2354 (10.9)	735 (3.4)
	5436 (25.3)	4144 (19.3)	1292 (6.0)
	4829 (22.5)	3537 (16.4)	1292 (6.0)
	5793 (26.9)	4393 (20.4)	1400 (6.5)
	2355 (10.9)	1906 (8.9)	449 (2.1)
Health facility level			
HC III	12345 (57.4)	9261 (43.1)	3084 (14.3)
HC IV	7664 (35.6)	5977 (27.8)	1687 (7.8)
General Hospital	1493 (6.9)	1096 (5.1)	397 (1.9)
Type of request			
Paper based	18117 (84.3)	16266 (75.7)	1851 (8.6)
Digital	3385 (15.7)	68 (0.3)	3317 (15.4)
Request option			
Not digital	18117 (84.3)	16266 (75.7)	1851 (8.6)
UgandaEMR	3268 (15.2)	67 (0.3)	3201 (14.9)
Extended LIMS	117 (0.5)	1 (0.0)	116 (4.6)
Reference laboratory			
	21001 (97.7)	15989 (74.4)	5012 (23.3)
	501 (2.3)	345 (1.6)	156 (0.7)

Viral load turnaround time

The mean VL TAT was 20 days, with a mean of 23.7 days (SD: 15.8). The median time from sample collection to receipt at the reference laboratory was 9 days, while the median time from receipt at the reference laboratory to testing was 5 days. The median time from testing to result printing was 3 days.

Continues to page 80

Continued from page 79

Interrupted time series analysis

During the pre-intervention period, weekly median VL TAT increased significantly overall, with a pre-intervention slope of 0.45 days per week (95% CI: 0.2−0.7; <0.001). Significant increasing pre-intervention trends were observed in all five districts. The steepest increase was in Ntoroko, 0.6 days per week (95% CI: 0.3−1.0; <0.001), followed by Kabarole, 0.3 days per week (95% CI: 0.2 to 0.4; <0.001), Bunyangabu, 0.3 days per week (95% CI: 0.1−0.5; p=0.002), Bundibugyo, 0.3 days per week (95% CI: 0.2−0.3; <0.001), and Fort Portal City, 0.2 days per week (95% CI: 0.0−0.5; p=0.034) (Table 2).

Immediately after roll-out of digital VL requests, weekly median VL TAT increased overall, by 28 days (95% CI: 19.0−36.4; <0.001). Statistically significant immediate increases were observed in all districts, ranging from 17 to 39 days in Bunyangabu and Kabarole (Table 1).

Following roll-out, the post-intervention trend in weekly median VL TAT declined significantly across all districts. Unlike the immediate change, this represented a reversal of TAT growth over the 15 post-intervention weeks. The overall post-intervention slope change was -3.0 days per week (95% CI: -4.0 to -2.0; <0.001). Declines were steepest in Kabarole, -3.6 days per week (95% CI: -4.4 to -2.9; <0.001), followed by Ntoroko, -3.4 days per week (95% CI: -5.2 to -1.6; <0.001), Fort Portal City, -2.6 days per week (95% CI: -3.7 to -1.4; <0.001), Bundibugyo, -2.5 days per week (95% CI: -3.7 to -1.4; <0.001), and Bunyangabu, -1.4 days per week (95% CI: -2.3 to -0.4; p=0.004); all five districts showed statistically significant declines (Table 2).

Combining the pre-intervention and post-intervention slope changes gave a negative net weekly change in median TAT after roll-out across all districts. After the initial post-roll-out spike, weekly median VL TAT reduced faster than it had previously been rising and by week 60 it had reduced back towards or below what it was in the pre- digital VL request period. (Figure 1). Overall, digital VL requests were associated with a short-term increase in weekly median VL TAT immediately after roll-out which could have been due to workflow adjustments followed by a significant sustained decline in TAT.

Table 2: Effect of barcode-linked VL request on trends of VL turnaround time in Rwenzori Region, Uganda, 2024–2025

District	ARIMA (p,d,q)	Pre-intervention trend (Wk1–45: 01/06/2024–06/04/2025)		Post-intervention: Immediate change (at Wk46: 07/04/2025)		Post-intervention: Trend (slope change) (Wk46–60: 07/04/2025–20/07/2025)	
		Estimated change (95% CI)	P-value	Estimated change (95% CI)	P-value	Estimated change (95% CI)	P-value
Bundibugyo	ARIMA (2,0,2)	0.3 (0.2, 0.3)	<0.001	31.2 (21.1, 41.2)	<0.001	-2.5 (-3.7, -1.4)	<0.001
Bunyangabu	ARIMA (0,0,2)	0.3 (0.1, 0.5)	0.002	16.6 (7.4, 25.8)	<0.001	-1.4 (-2.3, -0.4)	0.004
Fort Portal City	ARIMA (0,0,2)	0.2 (0.0, 0.5)	0.034	27.83(17.0, 38.7)	<0.001	-2.6 (-3.7, -1.4)	<0.001
Kabarole	ARIMA (0,0,0)	0.3 (0.2, 0.45	<0.001	38.4 (30.7, 46.1)	<0.001	-3.6 (-4.4, -2.9)	<0.001
Ntoroko	ARIMA (1,0,0)	0.6 (0.3, 1.0)	<0.001	23.7 (6.4, 41.1)	0.007	-3.4 (-5.1, -1.6)	<0.001
Overall	ARIMA (1,0,0)	0.4 (0.2, 0.7)	<0.001	27.7 (19.0, 36.4)	<0.001	-3.0 (-4.0, -2.0)	<0.001

Continues to page 81

Continued from page 80

Comparison of TAT for digital versus paper-based requests during the post-digital period

Of the 5,168 VL requests made in the post-digital period, 3,317 (64%) were digital requests. Median TAT between paper-based (36 days, IQR:25–49) and digital (35 days, IQR:25–45) VL requests were significantly ($p<0.001$) different but they were close to each other. This gap was not clinically meaningful but rather a gap due to the large sample size.

Discussion

Following rollout of digital VL requests, weekly median VL turnaround time (TAT) initially increased by about 28 days, but subsequently declined significantly, with an overall post-intervention slope change of −3.0 days per week. Significant declines were observed in all five districts, although the magnitude varied. This pattern suggests an initial implementation or workflow adjustment period followed by progressive improvement in TAT (2,8).

During the post-rollout period, median TAT was similar for digital and paper-based requests (35 versus 36 days). Although the difference was statistically significant, it was small and unlikely to be operationally meaningful. This suggests that the downward trend cannot be attributed solely to whether an individual request was digital; broader workflow changes accompanying rollout may also have contributed.

The findings indicate that digital VL request implementation was associated with a favorable change in the trajectory of TAT rather than an immediate reduction. Continued monitoring is needed to determine whether these improvements are sustained and whether increasing uptake of digital requests further reduces TAT (2,8).

Study limitations: The date results were printed at the hub was used as a proxy for receipt at the health facility and may therefore underestimate actual TAT. The study had no concurrent control group because digital VL requests were introduced programmatically, limiting causal attribution. Other changes occurring during implementation may also have contributed to the observed improvement.

Conclusion: Rollout of digital VL requests was associated with an initial increase in VL TAT followed by a significant sustained downward trend across all five districts. However, similar TATs for digital and paper-based requests during the post-rollout period suggest that the improvement may reflect both digitalization and accompanying workflow changes. Continued monitoring and strengthening of the digital VL request process are needed to determine whether these gains translate into sustained reductions in TAT.

Conflict of interest: The authors declare no competing interests.

Author Contributions: TE came up with the study idea, led the data collection, analysis, and interpretation, and wrote the first draft of the manuscript. GW and KDA reviewed the draft and contributed important intellectual input through several rounds of revisions. JN, IL, EAP, PM, also reviewed the bulletin and provided feedback to strengthen its intellectual content and scientific integrity.

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Discrepancies Between Routine Tuberculosis/HIV Mortality Reporting and Medically Certified Causes of Death, Uganda, 2020–2024.

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Summary

Background: Accurate cause-of-death ascertainment is essential for monitoring the impact of HIV and tuberculosis (TB) programs. In Uganda, aggregate TB/HIV death counts are routinely reported through the Health Management Information System (HMIS) 106a, while HMIS 100 records medically certified causes of death (MCCOD). Because medically certified cause-of-death information provides a more specific basis for determining underlying and contributing causes of death, we used HMIS 100 as the reference source. We assessed the extent to which routine TB/HIV mortality reporting corresponded with medically certified deaths in Uganda during 2020–2024.

Methods: We conducted a national retrospective evaluation using HMIS 106a and HMIS 100 data for 2020–2024. Tuberculosis/HIV deaths were defined as deaths among people living with HIV in which TB was recorded as an underlying or contributing cause of death. We compared TB/HIV death counts at national and health-facility levels; district-year was the unit of analysis. We calculated the certification ratio as HMIS 100 divided by HMIS 106a, expressed as a percentage. We calculated absolute differences and reporting ratios, and assessed agreement at the district-year level using Bland-Altman analysis, reported as mean bias and 95% limits of agreement (LOA).

Results: From 2020–2024, overall certification ratio was 5.4% (145/2,693). Annual certification ratio increased from 0.2% in 2020 to 12.9% in 2024. The absolute difference between systems remained large, declining from 547 deaths in 2020 to 481 in 2024. Marked geographic disparities were observed, with Busoga, Karamoja, and Teso regions recording no certified TB/HIV deaths, and no certification was documented at health center IV or lower-level facilities.

Continues to page 83

Continued from page 82

Bland-Altman analysis showed a mean bias of 8.7 deaths per district-year (95% LOA: -23.7–41.0), with HMIS 106a reporting approximately nine more TB/HIV deaths per district-year than HMIS 100.

Conclusion: Substantial and persistent discordance exists between routine TB/HIV mortality reporting and medically certified causes of death in Uganda, primarily driven by incomplete certification. Strengthening decentralized medical certification and integrating medical certification of causes of death into routine surveillance could improve the accuracy of TB/HIV mortality monitoring and decision-making.

Background

Tuberculosis (TB) remains a major cause of death among people living with HIV (PLHIV) (1). Globally, TB caused approximately 1.25 million deaths in 2023, and PLHIV are substantially more likely to develop TB and die during TB treatment than people without HIV. Tuberculosis accounts for nearly one-third of AIDS-related deaths worldwide (2, 3).

Uganda remains a high-burden country for both TB and HIV, with an estimated 96,000 new TB cases annually, about one-third occurring among PLHIV (4). Despite expanded access to antiretroviral therapy and TB preventive treatment, TB remains an important cause of mortality among PLHIV (5, 6). Accurate monitoring of TB/HIV deaths is therefore essential for assessing disease burden and guiding TB/HIV programme interventions(6).

In Uganda, TB/HIV deaths are routinely reported through the District Health Information System 2 using Health Management Information System (HMIS) 106a (7), while medically certified causes of death are recorded using the Medical Certificate of Cause of Death in HMIS 100 according to International Classification of Diseases standards (8, 9). However, incomplete medical certification and variation in diagnostic and certification practices may result in discrepancies between the two reporting systems.

We described trends in TB/HIV mortality reported through HMIS 106a and HMIS 100 in Uganda from 2020 to 2024 and quantified discrepancies between the two data sources by time, place, health facility level, and facility ownership.

Methods

We conducted a national descriptive evaluation of TB/HIV mortality data reported in Uganda from 2020–2024, covering all districts and health facilities. Data were extracted from DHIS2 using HMIS 106a for routinely reported TB/HIV deaths and HMIS 100 for medically certified causes of death coded according to ICD-10/ICD-11 standards. In HMIS 100, TB/HIV deaths were defined as deaths among people living with HIV in which TB was recorded as an underlying or contributing cause. All TB/HIV deaths reported in HMIS 106a were included.

Health management information system 100 data were aggregated to district-year level and used as the reference for cause-of-death attribution. Data were harmonized by year, region, district, health-facility level, and facility ownership. Discrepancy was defined as the difference in deaths reported by HMIS 106a and HMIS 100 for the same district-year and was assessed using reporting ratios, absolute differences, and Bland–Altman analysis. Positive differences indicated higher reporting in HMIS 106a. The certification ratio was calculated as HMIS 100 deaths divided by HMIS 106a deaths. Forty-six incomplete district-year observations were excluded from certification-ratio visualization. Trends and district-level choropleth maps were used to summarize mortality patterns. Bland–Altman analysis estimated the mean difference and 95% limits of agreement (mean difference ±1.96 SD), with linear regression used to assess magnitude-dependent disagreement. Analyses were descriptive, with no hypothesis testing.

The study used routinely collected programmatic data. Health management information system 100 records were de-identified before access, and no individual identifiers were analyzed. Ministry of Health clearance was obtained to access and analyze DHIS2 data. Formal ethical review was not required under national guidance for public health surveillance activities. The analysis was also reviewed by the US CDC and conducted in accordance with applicable data-protection requirements and US federal regulations.

Continues to page 84

Continued from page 83

Results

Certification coverage and absolute difference in death reporting through Health Management Information System 106a compared to Health Management Information System 100, Uganda, 2020–2024

Across 2020-2024, HMIS 106a reported 2,693 TB/HIV deaths compared to 145 in HMIS 100, an absolute difference of 2,548 (94.6%) and an overall certification of 5.4% (Figure 1). Routine reporting exceeded medically certified deaths in every year. The annual difference decreased from 547 deaths in 2020 to 481 in 2024, while certification ratio increased from 0.2% (1/548) to 12.9% (71/552).

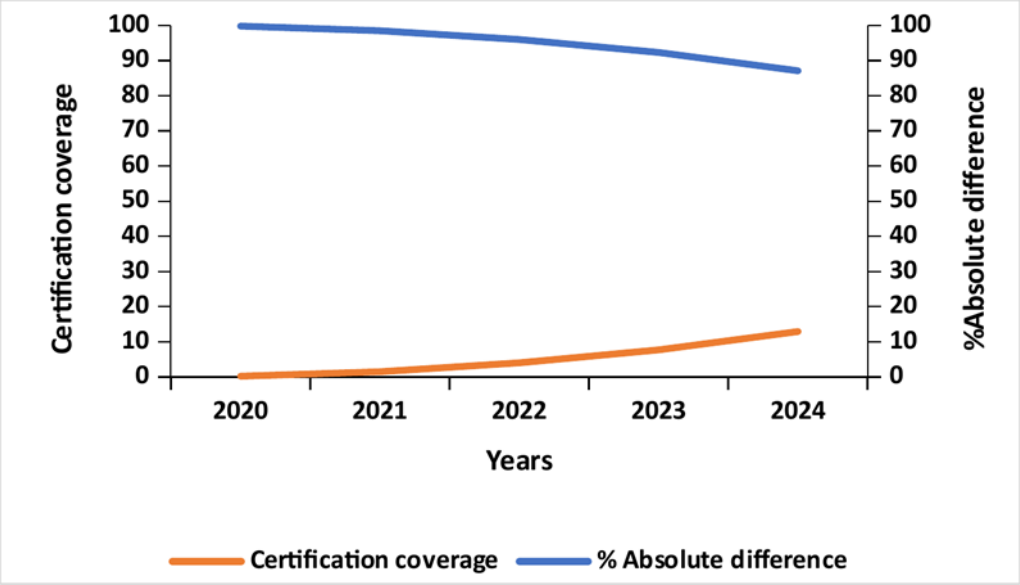


Figure 1: Certification coverage and absolute difference in death reporting through Health Management Information System 106a compared to Health Management Information System 100, Uganda, 2020–2024

Spatial Distribution of Certification ratio for tuberculosis/HIV mortality at district Level, Uganda, 2020–2024

Marked geographic variation was observed in certification ratio (Figure 2). In 2020–2021, most districts had either no medically certified TB/HIV deaths or ratio below 5%. From 2022 onward, districts with moderate certification ratio emerged, particularly those hosting higher-level referral facilities. By 2023–2024, some districts exceeded 20% ratio, although many remained below 10%. Busoga, Karamoja and Teso recorded no medically certified TB/HIV deaths during the five-year period.

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Teso recorded no medically certified TB/HIV deaths during the five-year period.

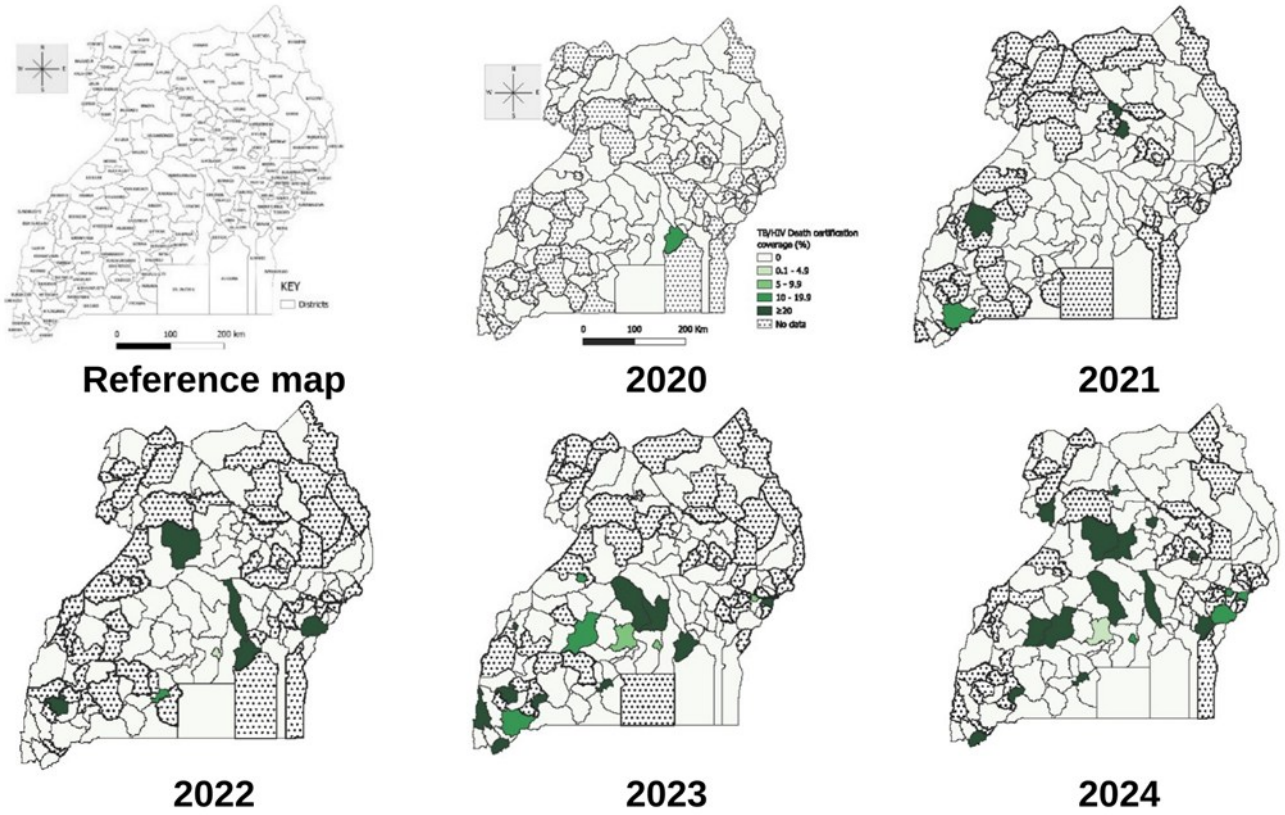


Figure 2: Spatial Distribution of Certification ratio for tuberculosis/HIV mortality at district Level, Uganda, 2020–2024

Trends in the number of tuberculosis/HIV deaths reported through Health Management Information System 106a and 100, by health facility, Uganda, 2020–2024

Certification was concentrated in higher-level health facilities. National and regional referral hospitals and general hospitals showed increasing numbers of medically certified deaths over time, with regional referral hospitals demonstrating a narrower reporting gap. No medically certified TB/HIV deaths were recorded in Health Centres IV or lower-level facilities during the study period (Figure 3).

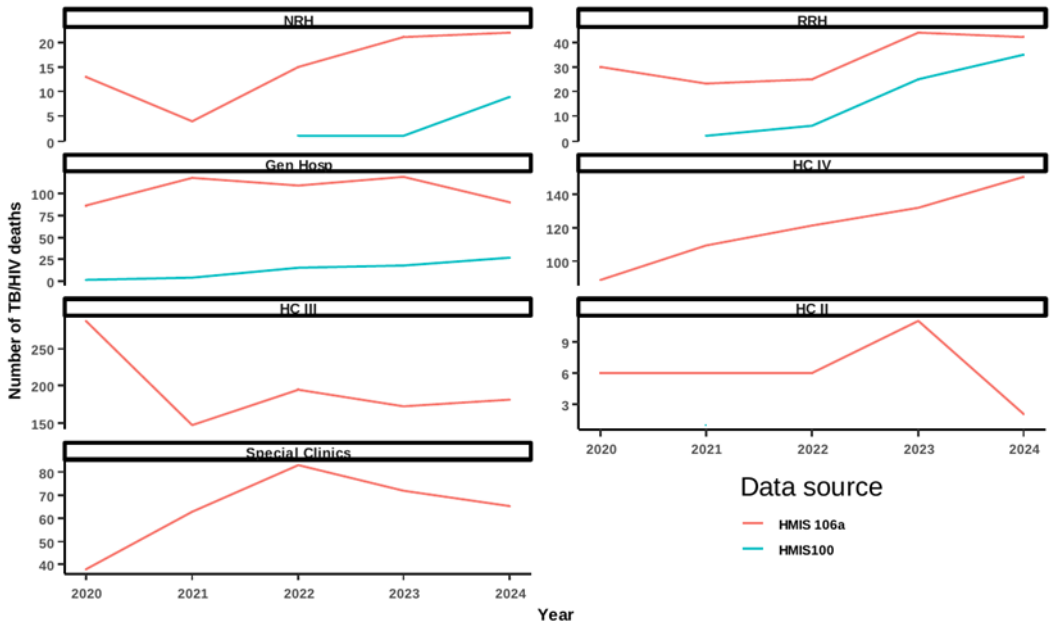


Figure 3: Trends in the number of tuberculosis/HIV deaths reported through Health Management Information System 106a and 100, by health facility, Uganda, 2020–2024

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Trends in concordance between Health Management Information System 106a and 100 in Uganda, by health facility ownership, 2020–2024

Ownership-based analysis showed greater convergence between the two systems over time among government-owned health facilities, while private-for-profit facilities had no recorded medically certified TB/HIV deaths (Figure 4).

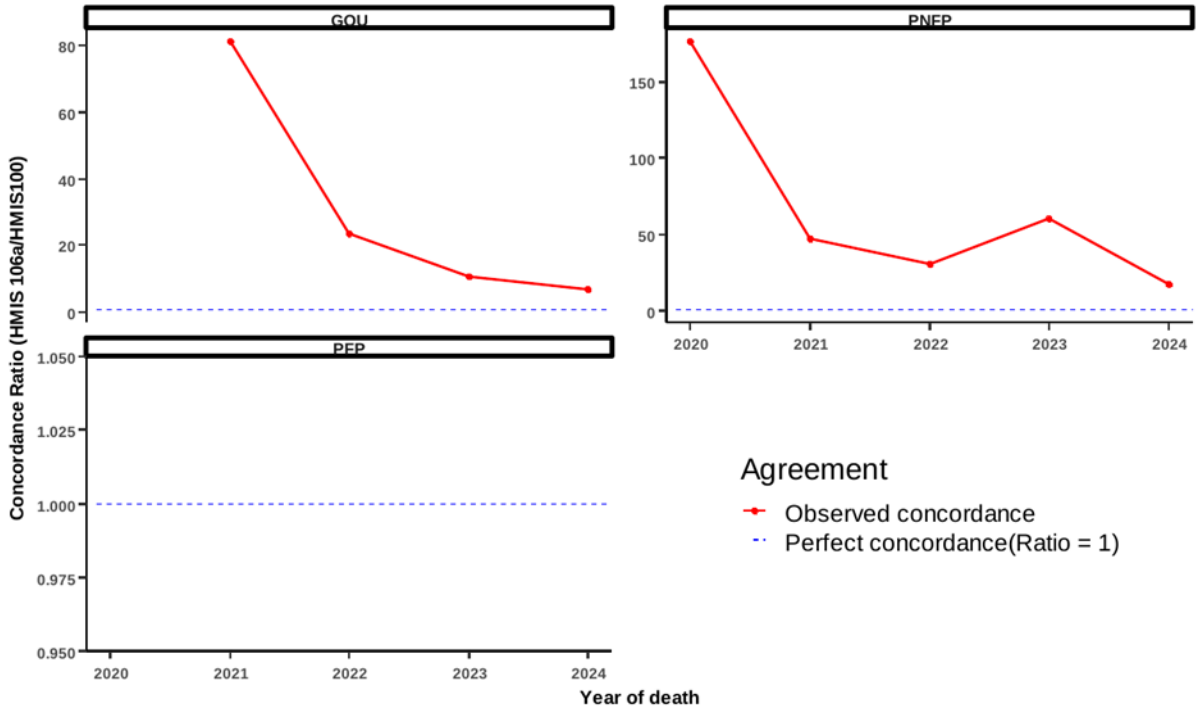


Figure 4: Trends in concordance between HMIS 106a and HMIS 100 in Uganda, by health facility ownership, 2020–2024

Assessment of disagreement between routine tuberculosis/HIV mortality reporting through Health Management Information System 106a and 100 at district-year level, Uganda, 2020–2024

At the district-year level, Bland-Altman analysis demonstrated systematic disagreement between the reporting systems. The mean bias was 8.7 deaths per district-year (95% LOA: −23.7–41.0), indicating that HMIS 106a reported approximately nine more TB/HIV deaths per district-year on average. The wide limits of agreement indicated substantial variability between districts, while increasing dispersion at higher mortality levels suggested magnitude-dependent disagreement (Figure 5).

Discussion

The increase in medically certified TB/HIV deaths coincided with implementation of Uganda's national mortality surveillance roadmap, which aims to strengthen death notification and medical certification (9). However, certification remained uneven across districts and facility levels. No medically certified TB/HIV deaths were recorded below general hospitals, suggesting important gaps in implementation of medical certification rather than absence of TB/HIV mortality at lower-level facilities.

Bland–Altman analysis showed systematic differences between the two systems, with larger discrepancies in districts reporting higher mortality. However, because HMIS 100 certification remains incomplete and the analysis used aggregate data, the observed differences cannot be attributed solely to over-reporting in HMIS 106a. They may reflect incomplete certification, differences in case ascertainment, reporting practices, or a combination of these factors (10).

Strengths and limitations: The study benefited from national coverage and comparison of two routine mortality reporting systems. Limitations included potential data-quality and classification errors, incomplete medical certification, exclusion of community deaths not captured by health facilities, and instability of estimates where certified deaths were few.

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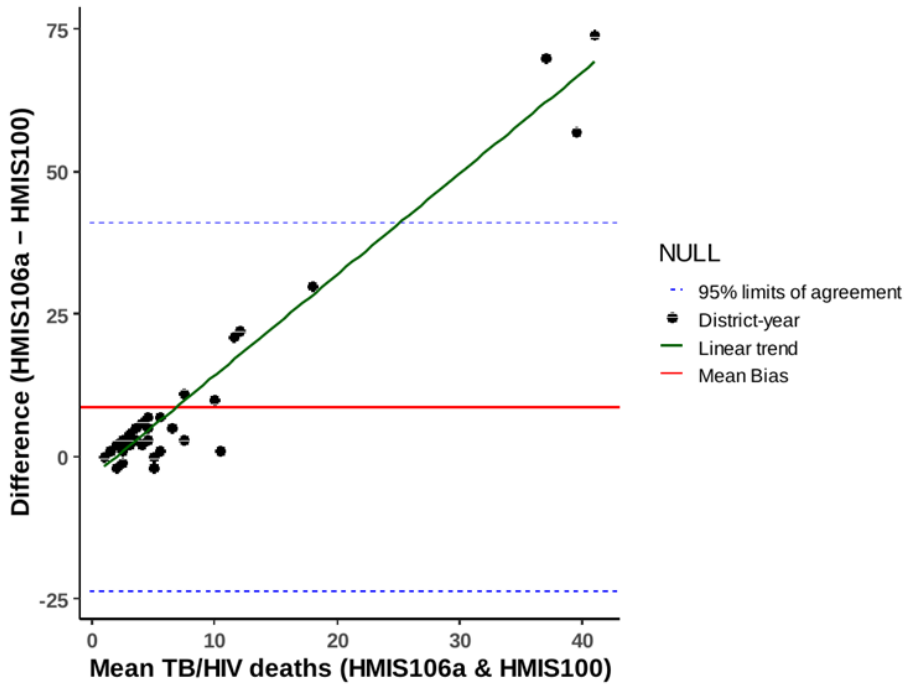


Figure 5: Bland-Altman plot assessing disagreement between routine tuberculosis/HIV mortality reporting through Health Management Information System 106a and 100 at district-year level, Uganda, 2020–2024

Conclusion: Substantial discrepancies existed between TB/HIV mortality reported through HMIS 106a and HMIS 100 in Uganda during 2020–2024. Although medical certification improved over time, certified TB/HIV deaths represented only 5.4% of deaths reported through HMIS 106a, with major gaps at lower-level health facilities. The Ministry of Health should strengthen medical certification training and supportive supervision, expand MCCOD reporting across facility levels, conduct routine data-quality audits, and improve linkage between medical certification and DHIS2 mortality reporting systems.

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

Author's contributions: NM conceptualized, led data collection, analysis, and report writing. IK, KDA, JM, IL supported data collection and review of draft report. RM, BK, YN, and FN supported technical review of data analysis, and report writing. NM and RM contributed to writing and reviewing the bulletin article to ensure scientific rigor and intellectual content. All authors reviewed and approved the final bulletin article for submission.

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Medical certification of cause of death as an emerging source for malnutrition mortality surveillance alongside District Health Information Software 2, Uganda, 2020–2025

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Summary

Background: Uganda mainly monitors malnutrition-related deaths through the District Health Information Software 2 (DHIS2), which captures deaths among children treated for severe (SAM) and moderate (MAM) acute malnutrition. The Medical Certificate of Cause of Death (MCCD) system captures certified causes of death across all ages and may identify malnutrition as an underlying, intermediate, or contributing cause. We described malnutrition-related deaths captured through MCCD and examined what additional information it provides alongside DHIS2 treatment-outcome data in Uganda during 2020–2025.

Methods: We analysed MCCD records from January 2020 to December 2025 and identified deaths in which malnutrition was the underlying cause, part of the causal sequence, or a contributing condition.

We calculated annual MCCD-recorded death rates per 1,000,000 population and counted the facilities certifying malnutrition-related deaths each year. From DHIS2, we extracted deaths during SAM and MAM treatment and calculated case fatality rates. We described each system separately and assessed trends using the Mann–Kendall test.

Results: Of 56,443 MCCD records screened, 857 (1.5%) were malnutrition-related; in 447 (52.2%), malnutrition was not the underlying cause. Facilities certifying at least one malnutrition-related death increased from 1 in 2020 to 57 in 2024. The MCCD-recorded death rate rose from 0.02 per 1,000,000 population in 2020 to 7.21 in 2024; 2022–2025 (τ=0.67, p=0.31). Children aged 1–4 years accounted for 273/744 (36.7%) deaths with known age. Regional referral hospitals certified 463 (54.0%) deaths. DHIS2 recorded 2,898 deaths during SAM/MAM treatment; the case fatality rate showed no significant trend (τ=0.07, p=1.0) and was highest at the national referral hospital (2.32%).

Conclusion: More than half of malnutrition-related deaths identified through MCCD had malnutrition recorded as an intermediate or contributing condition rather than the underlying cause, demonstrating the additional information available from cause-of-death certification. MCCD also identified malnutrition-related deaths across age groups beyond those routinely captured through SAM/MAM treatment reporting. However, certification remained concentrated in referral hospitals and coverage was incomplete. Continued expansion of MCCD could provide a broader picture of malnutrition-related mortality alongside DHIS2 treatment-outcome surveillance.

Continues to page 89

Continued from page 88

Background

Malnutrition remains an important contributor to child mortality (1). In Uganda, 25.4% of children under five were stunted, 10.0% underweight, and 3.6% wasted in 2022 (2), while in-hospital mortality among children with severe acute malnutrition (SAM) has ranged from about 10% to 25% (3,4).

Malnutrition-related deaths among children receiving treatment are routinely reported through the District Health Information Software 2 (DHIS2), which captures aggregate severe acute malnutrition (SAM) and moderate acute malnutrition (MAM) cases and treatment outcomes but does not record certified causes of death (5). The Medical Certificate of Cause of Death (MCCD) system captures causes of death across all ages, coded using the International Classification of Diseases, 11th Revision (ICD-11) (6,7), and is still being expanded across health facilities in Uganda (8,9).

We described malnutrition-related deaths captured through MCCD during 2020–2025 alongside DHIS2 treatment outcomes to assess what MCCD currently contributes to malnutrition mortality surveillance and identify gaps as the system continues to expand..

Methods

We conducted a descriptive analysis of routinely collected malnutrition-related mortality data from the MCCD system and DHIS2 in Uganda during 2020–2025.

For MCCD, we screened coded and free-text cause-of-death fields for malnutrition-related ICD-11 codes and terms. Deaths were classified into three mutually exclusive categories: Category A**,** malnutrition recorded as the underlying cause of death; Category B, malnutrition recorded elsewhere in the causal sequence; and Category C**,** malnutrition recorded only as a contributing condition. We described deaths by age, sex, facility level, district, and year, and calculated annual recorded-death rates per 1,000,000 population using Uganda Bureau of Statistics population projections. We also tracked the number of facilities certifying at least one malnutrition-related death each year.

From DHIS2, we extracted SAM and MAM cases and deaths occurring during treatment and calculated case fatality rates. The two systems capture complementary aspects of malnutrition mortality: DHIS2 reflects treatment outcomes among children identified with SAM or MAM, while MCCD captures malnutrition as an underlying, intermediate, or contributing cause among medically certified deaths across all ages. Because the systems differ in purpose, coverage, and case definitions and could not be linked at individual level, they were analysed separately rather than directly comparing death counts.

Temporal trends were assessed using the Mann–Kendall test and Sen's slope, with MCCD trends also examined for 2022–2025 because coverage was limited in earlier years.

The analysis used de-identified routine surveillance data and was conducted as non-research public health practice with Ministry of Health authorization and U.S. CDC granting non-research determination.

Results

Malnutrition-related deaths captured through MCCD, Uganda, 2020–2025

Of 56,443 MCCD death records screened, 857 (1.5%) were malnutrition-related. Malnutrition was the underlying cause of death (Category A) in 410 (47.8%), part of the causal sequence (Category B) in 210 (24.5%), and a contributing condition only (Category C) in 237 (27.7%).

Annual certified malnutrition-related deaths rose from 1 in 2020 to a peak of 325 in 2024 and were 243 in 2025, while the number of facilities certifying at least one malnutrition-related death rose from 1 in 2020 to 57 in 2024 (Figure 1).

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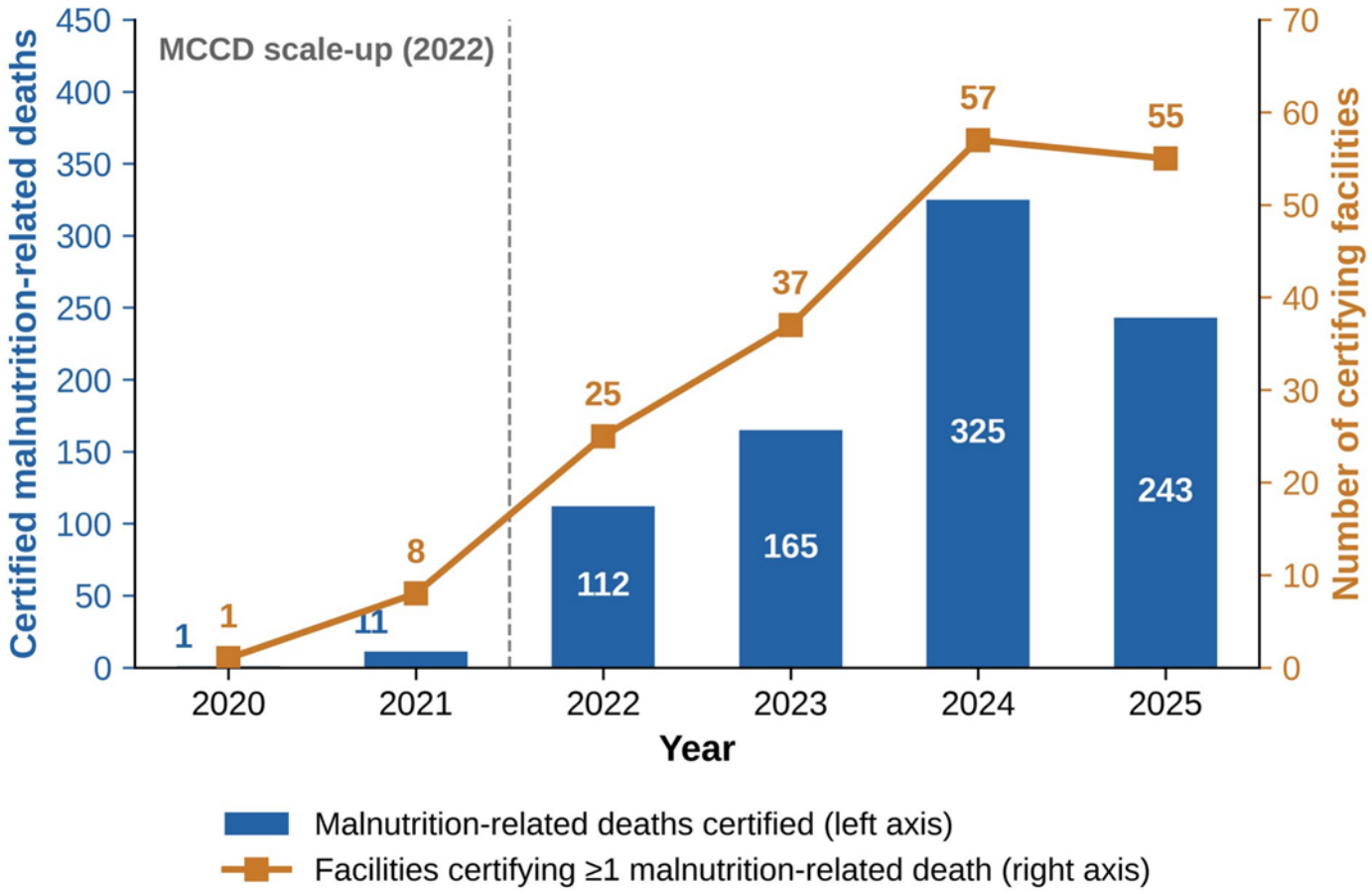


Figure 1: Annual malnutrition-related deaths certified and facilities certifying at least one malnutrition-related death, Medical Certificate of Cause of Death system, Uganda, 2020–2025

The MCCD-recorded malnutrition-related death rate rose from 0.02 per 1,000,000 population in 2020 to a peak of 7.21 in 2024, before declining to 5.11 in 2025 (τ=0.87, p=0.024; Sen's slope 1.21 per 1,000,000 population per year); when restricted to 2022–2025, after scale-up began, the trend was not statistically significant (τ=0.67, p=0.31). DHIS2 recorded 2,898 deaths during treatment for SAM (n=2,210) and MAM (n=688). Neither annual DHIS2 deaths (τ=0.33, p=0.45) nor the DHIS2 case fatality rate (τ=0.07, p=1.0) showed a significant trend, including for 2020–2024 (τ=0.60, p=0.22).

Malnutrition-related deaths by health facility level, MCCD and DHIS2, Uganda, 2020–2025

In MCCD, regional referral hospitals certified more than half of malnutrition-related deaths (463/857; 54.0%) and general hospitals about one-third (308; 35.9%); lower-level facilities certified few. (Figure 2). Kayunga Regional Referral Hospital (79; 9.2%) and Butabika National Referral Hospital, Uganda's national referral facility for mental health (61; 7.1%), certified the most deaths. In DHIS2, the case fatality rate increased with facility level; from 0.24% at Health Centre II, to 2.32% at the national referral hospital.

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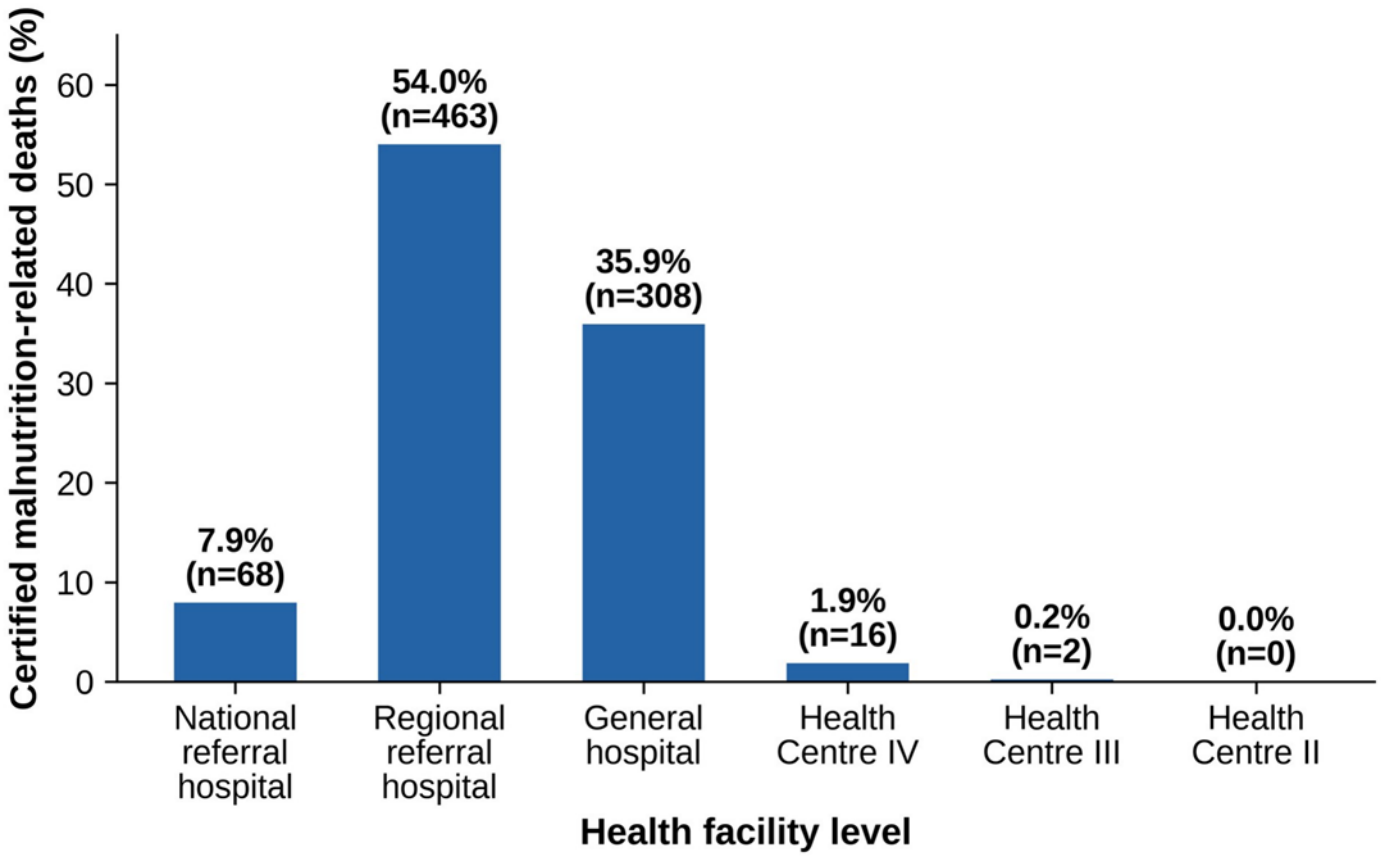


Figure 2: Distribution of malnutrition-related deaths certified in the Medical Certificate of Cause of Death system by health facility level, Uganda, 2020–2025

Age, sex, and geographical distribution of malnutrition-related deaths, DHIS2 and MCCD, Uganda, 2020–2025

In MCCD, children aged 1–4 years accounted for the largest share of deaths with known age (273/744; 36.7%) and adults aged 25–64 years for 215 (28.9%). The cumulative 2020–2025 recorded -death rate was higher among males (22.5 per 1,000,000 population) than females (15.1 per 1,000,000). Severe acute malnutrition was the most commonly certified type (441/857; 51.5%), followed by unspecified undernutrition (362/857; 42.2%). Cumulative MCCD-recorded deaths per 1,000,000 residents during 2021–2025 were highest in Kampala (48.5), Kigezi (32.3), Bunyoro (30.4), and North Buganda (30.2) regions, and the highest district values were in Kayunga, Moroto, Nebbi, Lira, and Hoima. 65 of Uganda's 146 districts (44.5%) recorded at least one certified death. In DHIS2, children aged 6–23 months accounted for the largest share of SAM/MAM deaths (1,165/2,898; 40.2%) and had the highest case fatality rate (0.72%), and case fatality was higher among males (0.54%) than females (0.39%).

Discussion

This analysis shows that MCCD is beginning to provide information on malnutrition-related mortality that is not available from routine SAM/MAM treatment reporting alone.

Continues to page 92

Continued from page 91

Of the 857 malnutrition-related deaths identified through MCCD, only 47.8% had malnutrition recorded as the underlying cause; in the remaining 52.2%, malnutrition appeared elsewhere in the causal sequence or as a contributing condition. This demonstrates the value of reviewing the full medical cause-of-death sequence rather than relying only on deaths in which malnutrition is recorded as the underlying cause (1).

MCCD also captured malnutrition-related deaths across a broader age range. Although children aged 1–4 years accounted for the largest proportion of deaths with known age, almost one-third occurred among adults aged 25–64 years. In contrast, DHIS2 malnutrition mortality reporting reflects deaths occurring among children identified and treated for SAM or MAM. These findings highlight the complementary roles of the two systems: DHIS2 provides information on outcomes among children receiving acute-malnutrition treatment, while MCCD can describe the contribution of malnutrition to medically certified deaths across the life course. The death counts from the two systems should therefore not be interpreted as directly comparable measures of the same mortality burden.

The increase in MCCD-recorded malnutrition-related deaths over time occurred alongside a substantial expansion in the number of facilities certifying such deaths. The number of certifying facilities increased from one in 2020 to 57 in 2024, while the recorded death rate increased from 0.02 to 7.21 per million population. However, when the trend analysis was restricted to 2022–2025, after expansion of the system began, the increase was not statistically significant. This suggests that much of the observed increase in recorded mortality may reflect improving MCCD coverage and implementation rather than a true increase in malnutrition-related mortality. MCCD rates should therefore be interpreted as rates of recorded certified deaths, rather than estimates of the national mortality burden.

Coverage also remained concentrated in higher-level facilities. Regional referral hospitals and general hospitals accounted for nearly 90% of MCCD-recorded malnutrition-related deaths, while only 65 of Uganda's 146 districts recorded at least one certified death. This concentration likely reflects the current stage of MCCD implementation (8) and limits geographic comparisons, since areas with stronger certification may appear to have higher mortality simply because more deaths are being medically certified. A similar concentration in referral hospitals was reported for certified neonatal sepsis deaths (10). Continued expansion of medical certification to additional hospitals and lower-level facilities would improve the representativeness and usefulness of MCCD for malnutrition mortality surveillance.

Overall, the findings suggest that MCCD should not replace DHIS2 malnutrition treatment-outcome reporting. Rather, the systems provide different but complementary information: DHIS2 monitors outcomes among identified SAM/MAM cases, while MCCD provides information on how malnutrition contributes to medically certified deaths, including deaths outside childhood and those in which malnutrition is not the underlying cause. Strengthening MCCD coverage could therefore broaden Uganda's understanding of malnutrition-related mortality while DHIS2 continues to monitor programme-based treatment outcomes (8).

Study limitations: MCCD included only medically certified deaths from participating facilities, and facility coverage changed over time; therefore, MCCD counts and recorded-death rates should not be interpreted as national mortality estimates. Deaths were attributed to the certifying facility rather than the deceased person's residence, so referral patterns may have influenced geographic distributions. Cause-of-death information may also have been affected by incomplete documentation and variation in certification and coding practices.

For DHIS2, the case fatality denominator comprised SAM/MAM cases identified at screening rather than only those admitted for treatment. Changes in the reporting form also affected one year's case fatality estimate; however, restricting the trend analysis to 2020–2024 did not change the overall conclusion.

Conclusion: More than half of malnutrition-related deaths identified through MCCD had malnutrition recorded outside the underlying-cause position, demonstrating information that is not available from routine SAM/MAM treatment-outcome reporting alone.

Continues to page 93

However, MCCD coverage remains incomplete and concentrated in referral and general hospitals, and the increase in recorded deaths over time largely reflects expansion of medical certification rather than a demonstrated rise in population mortality. As coverage expands, the Ministry of Health should strengthen certification beyond higher-level facilities and routinely review MCCD findings alongside DHIS2 treatment outcomes to provide a broader understanding of malnutrition-related mortality in Uganda.

Conflict of interest: The authors declare no competing interests.

Author Contributions: WN conceptualised the study, led data collection, analysis, and interpretation and wrote the draft article. RM and BK reviewed the draft and made multiple edits for intellectual content. SN, JW, SN, TE, PEO, CN and IK reviewed the article for intellectual content and scientific integrity. All authors read and approved the final article.

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Upcoming Health Events

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Introduction: Global health commemorative days and scientific conferences provide platforms to raise awareness about priority public health issues and to share evidence for action. The October–December quarter includes days dedicated to mental health, breast cancer, infection prevention, pneumonia, diabetes, antimicrobial resistance and HIV, alongside national, professional and continental scientific conferences among others. These occasions offer governments, institutions, partners, communities and individuals an opportunity to strengthen advocacy, improve public understanding, and promote actions that contribute to better health outcomes.

World Mental Health Day: 10th October 2026

More than one billion people worldwide live with a mental health condition, yet many do not receive the care they need.



World Mental Health Day is observed annually on 10 October to raise awareness of mental health and mobilise efforts in support of mental well-being. The 2026 theme, “Lived Experiences Heard: Real Voices, Real Change”, set by the World Federation for Mental Health, places people with lived experience of mental health conditions at the centre of efforts to shape services, reduce stigma and improve care. Governments, health institutions, employers, communities and families are encouraged to listen to people with lived experience, challenge stigma and discrimination, and support access to community-based mental health services.

Continues to page 95

Continued from page 94

Breast Cancer Awareness Month: 1st–31st October 2026

Breast cancer is the most commonly diagnosed cancer among women worldwide; in 2022, 2.3 million women were diagnosed and 670,000 died from the disease.



Breast Cancer Awareness Month is observed every October to raise awareness of breast cancer and the importance of early detection. In Uganda, more than 4,000 new cases are recorded each year, and nearly 80% of patients are diagnosed at an advanced stage, when treatment outcomes are poorer. Echoing the Uganda Cancer Institute's message that early detection saves lives, the month encourages women to perform regular breast self-examination, attend clinical breast examination and seek care promptly for any breast lump or change. Health facilities and community health workers are encouraged to use the month to expand screening and referral for timely diagnosis and treatment.

International Infection Prevention Week: 18th–24th October 2026

Out of every 100 patients in acute-care hospitals, about seven in high-income countries and 15 in low - and middle-income countries acquire at least one health care-associated infection.



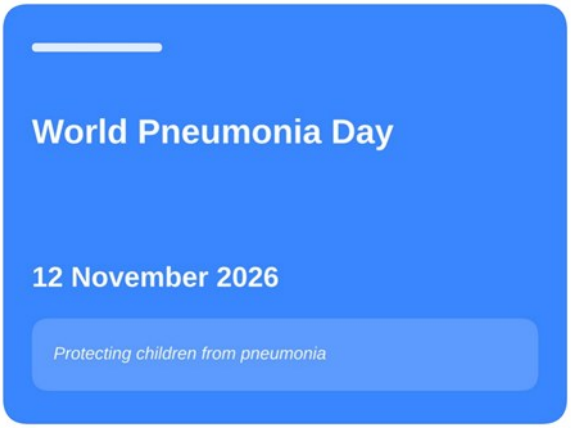
International Infection Prevention Week is observed during the third week of October to highlight the role of infection prevention and control (IPC) in protecting patients, health workers and communities. About one in ten patients who acquire a health care-associated infection die, and World Health Organization (WHO) estimates that up to 70% of these infections can be prevented through good IPC practices, including hand hygiene, safe injection practices, environmental cleaning and appropriate use of personal protective equipment. Uganda's recent outbreaks, including the Sudan virus disease outbreak in 2025 and the ongoing Ebola response, have shown that sustained IPC practices in health facilities protect health workers and help prevent onward transmission. Health facility managers, health workers, patients and caregivers are encouraged to make IPC part of every encounter in care.

Continues to page 96

Continued from page 95

World Pneumonia Day: 12th November 2026

Pneumonia is the single largest infectious cause of death in children worldwide; in 2019, it killed 740,180 children under five years of age, accounting for 14% of all deaths in this age group.



World Pneumonia Day is observed annually on 12 November to raise awareness of pneumonia and promote actions to prevent and treat it. Most pneumonia deaths are preventable. Pneumonia can be prevented through exclusive breastfeeding for the first six months of life, adequate nutrition, vaccination against pneumococcus, Haemophilus influenzae type b (Hib) and measles, and reduction of household air pollution. Caregivers are encouraged to seek care promptly when a child has a cough with fast or difficult breathing, while health workers and Village Health Teams are encouraged to identify and treat cases early.

World Diabetes Day: 14th November 2026

More than 40% of people living with diabetes worldwide have not been diagnosed.



World Diabetes Day is a global campaign to raise awareness of diabetes and the need for better prevention and care. The 2026 theme, “Early action on diabetes”, highlights the value of timely diagnosis and treatment, as many people present only when complications such as kidney disease, vision loss, heart disease or lower-limb amputation have developed. WHO Member States have committed to five global diabetes coverage targets for 2030, the first of which is that 80% of people living with diabetes are diagnosed. Communities are encouraged to adopt healthy diets and regular physical activity and to go for blood glucose screening, while health facilities are encouraged to integrate diabetes screening into routine services.

Continues to page 97

Continued from page 96

World Antimicrobial Resistance Awareness Week: 18th–24th November 2026

Bacterial antimicrobial resistance was directly responsible for an estimated 1.27 million deaths globally in 2019 and contributed to 4.95 million deaths.



World Antimicrobial Resistance (AMR) Awareness Week is observed annually from 18 to 24 November to improve awareness and understanding of AMR and to encourage best practices among the public, health workers, animal health professionals and policy makers. The 2026 theme, “One Health, one action: Prevent AMR now”, calls for joint action across human, animal and environmental health. The public is encouraged to use antibiotics only when prescribed by a qualified health worker, to complete prescribed courses, and to avoid sharing antibiotics or self-medicating, while farmers are encouraged to use antimicrobials in animals only under veterinary guidance.

World AIDS Day: 1st December 2026

Uganda has reduced new HIV infections from 96,000 in 2010 to 37,000 in 2024, yet infections among adolescent girls and young women remain a major concern.



World AIDS Day is observed every year on 1 December to raise awareness of HIV and AIDS, honour those who have died of AIDS-related illnesses, and renew commitment to ending AIDS as a public health threat by 2030. AIDS-related deaths in Uganda fell from 56,000 in 2010 to 20,000 in 2024; among people living with HIV, 94% know their status, 90% of those diagnosed are on antiretroviral therapy, and 96% of those on treatment have achieved viral suppression. Despite these gains, girls accounted for about four in every five new infections among adolescents in 2024. This year’s commemoration is an opportunity to intensify HIV prevention among adolescents and young women, including HIV testing, pre-exposure prophylaxis, condom use and comprehensive sexuality information, to reduce stigma, and to keep people living with HIV on treatment.

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