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Dear Reader,

We take great pleasure in welcoming you to Issue 1 Volume 10 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: Mpox studies in Nakasongola, Kasese, Mayuge, Mukono Districts and Masindi Prison, Uganda; Application of 7-1-7 matrix in a One Health context during the first anthrax outbreak in Kanungu District, Southwestern Uganda, September 2024; Trends and distribution of acute flaccid paralysis cases and their outcomes among children below 15 years, Uganda, 2016–2023; Trends and distribution of Leprosy cases, Uganda, 2020–2024, tracking progress towards elimination; Trends and Spatial distribution of all-cause Mortality, Uganda, 2018–2023;Trends and distribution of malaria mortality among children and adolescents aged 0-17 years, Uganda, 2023: descriptive analysis of Medically Certified Cause of Death data; and Trends and distribution of HIV incidence among children aged 0-14 years, Uganda, 2015–2023.

Should you have any questions or require additional information related to articles in this bulletin please contact us on: okiroreo@uniph.go.ug, jokobusingye@uniph.go.ug, wagwang@uniph.go.ug, olivenamakula@uniph.go.ug, lbulage@uniph.go.ug.

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Epidemiological characteristics and transmission dynamics of the first 66 confirmed Mpox cases, Nakasongola District, Uganda, September-November 2024

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Summary

Background: The Uganda Ministry of Health (MoH) declared the first Mpox outbreak on August 2, 2024, after two confirmed Mpox cases were reported in Kasese District. On September 9, 2024, Nakasongola District registered its first confirmed Mpox case.
We described the epidemiological characteristics and transmission dynamics of the first 66 confirmed Mpox cases in Nakasongola District to inform interventions for ongoing Mpox outbreaks in other districts.
Methods: We conducted case investigations to obtain data on socio-demographic characteristics, exposures, signs, symptoms and contacts. We reported the mean age, proportions of the cases by sex, age and occupation. We calculated the attack rates (ARs) per sex, age group, and sub-county by determining the number of cases per population per 100,000.
Findings: Between September 9-November 30, 2024, a total of 66 confirmed cases were reported in Nakasongola District. The majority of cases were male [36 (55%)] and aged ≥15 years [51(77%)] with the mean age of 26 years (IQR 20-30). The highest proportion of cases were fisherfolks [16(25%)] and commercial sex workers (CSWs) [8(13%)]. Females (AR=27/100,000) and males (28/100,000) were similarly affected. The most affected age group were ≥15 years (AR=43/100,000) than those in other age groups [<5 years (AR=13/100,000), and 5-14 years (12/100,000). Lwampanga Town Council (TC) was the most affected subcounty (AR=266/100,000). There were five clusters of transmission in Lwampanga TC, with the largest two occurring at Zengebe Landing Site and Kijaluwo Village, primarily facilitated by sexual contact with six linkages. sub-counties and town councils.
Conclusion: CSWs played a key role in transmission and both fisherfolk and CSWs were at higher risk of acquiring Mpox. Prompt isolation of Mpox cases, along with targeted risk communication and community engagement efforts directed at these high-risk groups in the most affected town council may help prevent further spread to other sub-counties and town councils.

Background

The first Mpox (formerly known as monkeypox) caused by monkeypox virus (MPXV), was identified in the Democratic Republic of Congo (DRC) (1,2). Mpox has been endemic in West and West African regions of the continent (2,3). However, there was a global increase in the number of Mpox cases in 2022. While cases initially declined, Mpox cases increased again in 2024 leading to the declaration as a public health emergency of international concern in 2024 (4,5).

On August 2, 2024, the Ministry of Health (MoH), Uganda, declared its first Mpox outbreak in the country (11). On September 9, 2024, Nakasongola District reported its first confirmed Mpox case. As of October 31, 2024, a cumulative of 287 cases were reported across 28 districts of the country (12). Among the 28 districts, Nakasongola was among the top five districts with the most cases. We described the epidemiological characteristics and transmission dynamics of the first 66 confirmed Mpox cases in Nakasongola District and recommended evidence-based measures to inform ongoing response elsewhere in Uganda.

Methods

Nakasongola District is situated in Central Uganda. The district is divided into eight sub-counties and seven town councils. The district is bordered by Lake Kyoga in the north, northeast, and east with fishing landing sites, especially in Lwampanga TC, making fishing an important socioeconomic activity in this area.

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We defined suspected, probable, and confirmed cases as per the MoH Uganda standard case definition for Mpox.

We conducted field investigations and used the MoH standardized case investigation, contact listing and follow up forms to collect data on confirmed cases and contacts of cases. Data were collected on demographics, clinical characteristics, and exposures of the cases. We calculated attack rates using projected populations from the Uganda Bureau of Statistics. For the confirmed Mpox cases, we calculated proportions and attack rates by sex, age group, and sub-county or town council. We plotted epidemic curve of confirmed cases by date of symptom onset to demonstrate trends, stratified by occupation. Using choropleth maps in Quantum Geographical Information System (QGIS), we depicted attack rates of confirmed Mpox cases per sub-county or town council of residence.

This investigation was conducted in response to public health emergency by the National Rapid Response Team. The Ministry of Health Uganda provided administrative clearance to conduct this investigation. 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. Furthermore, all the respondents gave individual verbal consent or assent for interviews since the investigation presented no more than minimal risk of harm and involved no procedures for which written consent is normally required in other contexts. We conducted the interviews in privacy to ensure confidentiality and the data kept under password protection by the study team.

Results

Descriptive epidemiology

As of November 30, 2024, there were 66 confirmed Mpox cases and 10 probable Mpox cases with no death. Of the 66 confirmed cases, five (23%) tested HIV positive. The hospitalization rate was 63%.

All confirmed cases had skin rash/lesions. Fifty-four percent presented with fever**,** 49% had sore throat, and 46% headache **(**Figure 1). Lesions most often presented on the face, followed by the arms and genitals, with 48% having genital lesions (Figure 2).

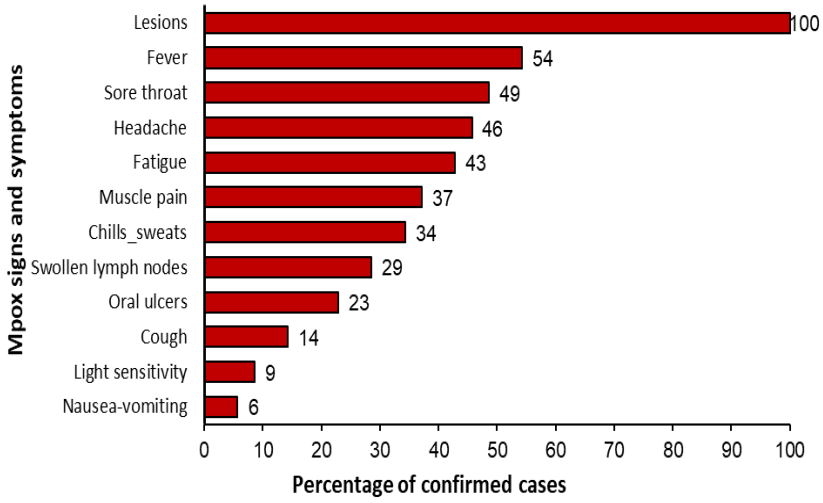

Figure 1: Clinical presentation of confirmed Mpox cases, Nakasongola District, Uganda, September-November 2024

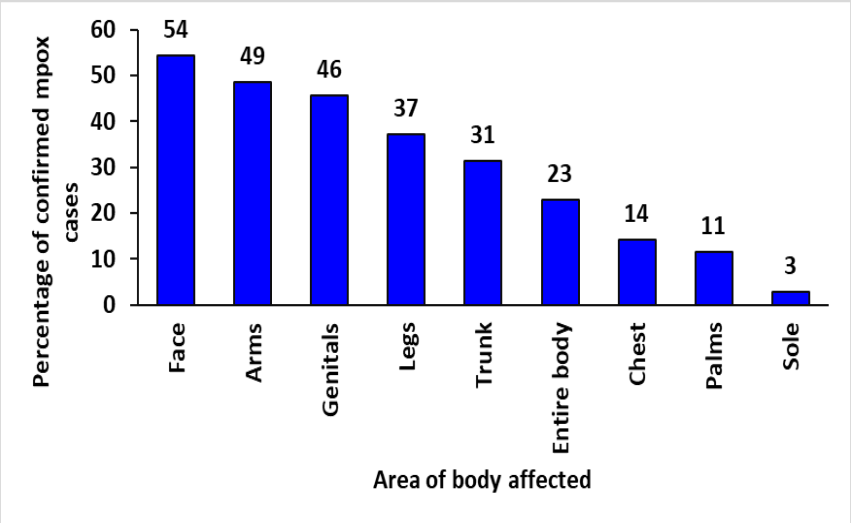

Figure 2: Distribution of skin rash on body parts among Mpox confirmed cases, Nakasongola District, Uganda, September-November 2024

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Among the 66 confirmed cases, the majority were male [36 (55%)], aged 15 years and above [51(77%)], with the mean age of 26 years (IQR 20-30). The highest occupational categories among confirmed cases were fisherfolk [16(25%)] and commercial sex workers (CSWS) [8(13%)] (Figure 3).

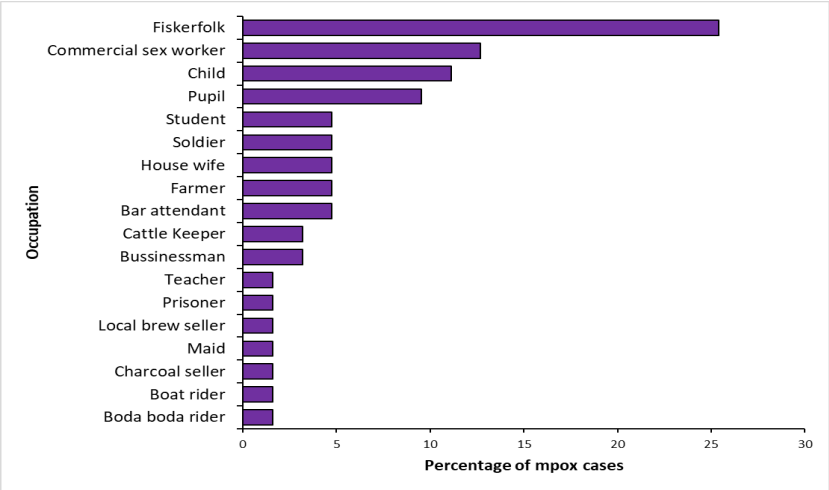

Figure 3: Distribution of confirmed Mpox cases by occupation, Nakasongola District, Uganda, September-November 2024

Among the confirmed Mpox cases, males (AR=28/100,000) and females (AR=27/100,000) were similarly affected. Those aged 15 years and above were the most affected (AR=43/100,000).

The overall Mpox attack rate in Nakasongola District was 28 /100,000 cases. Lwampanga TC (AR=266/100,000), Lwabiyata Subcounty (SC), (AR=63/100,000), Nakasongola TC (AR=38/100,000), Lwampanga SC (31/100,000) were the most affected sub-counties/town councils (Figure 4).

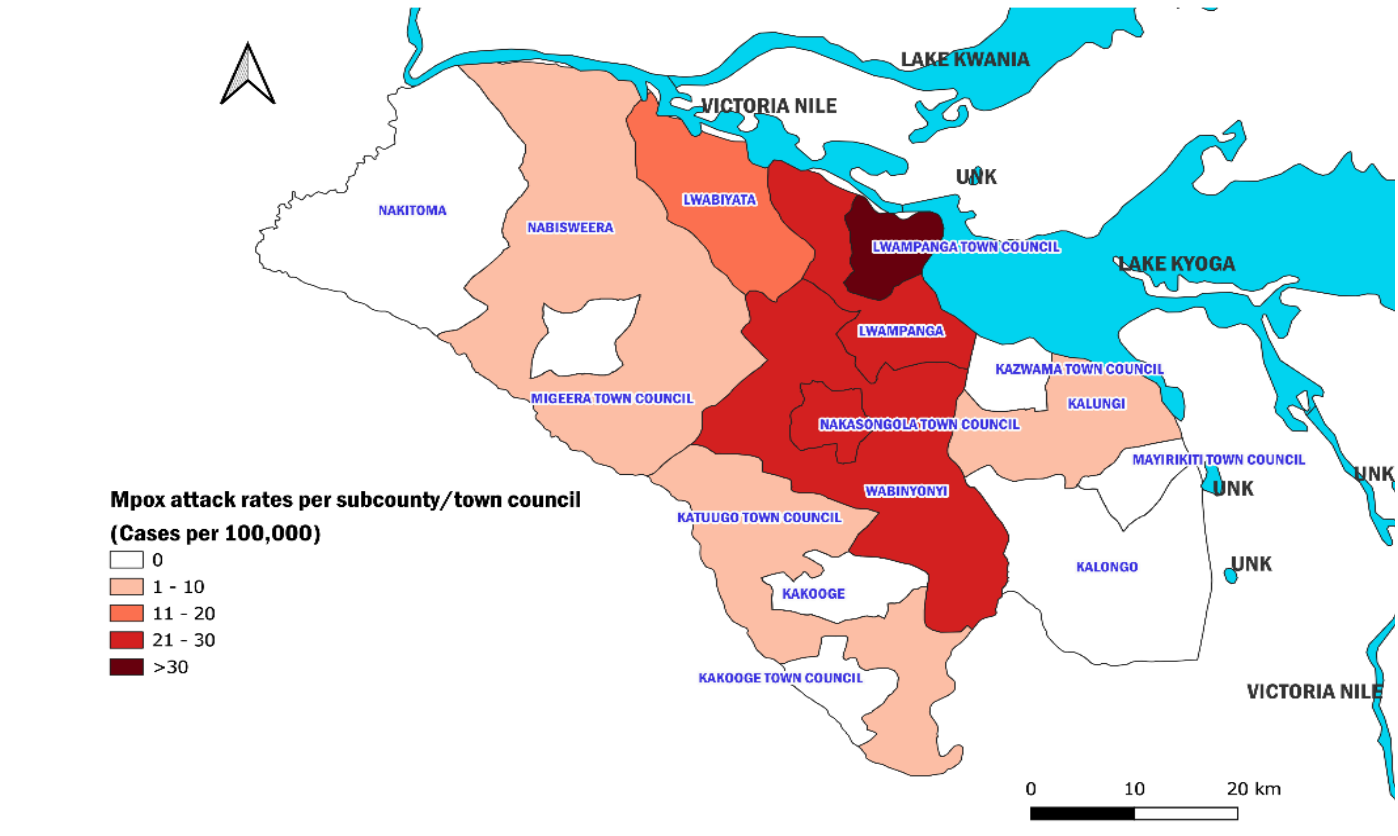

Figure 4: Attack rates of confirmed Mpox cases by sub-county or town council, Nakasongola District, Uganda, September-November, 2024

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The early confirmed Mpox cases were mainly fisherfolks and commercial sex workers (Figure 5). Mpox cases after September 17, 2024 were mainly of students, children and housewives. Furthermore, from October 16-November 30, 2024 there were few cases among fisherfolk and CSWs as seen on the epicurve.

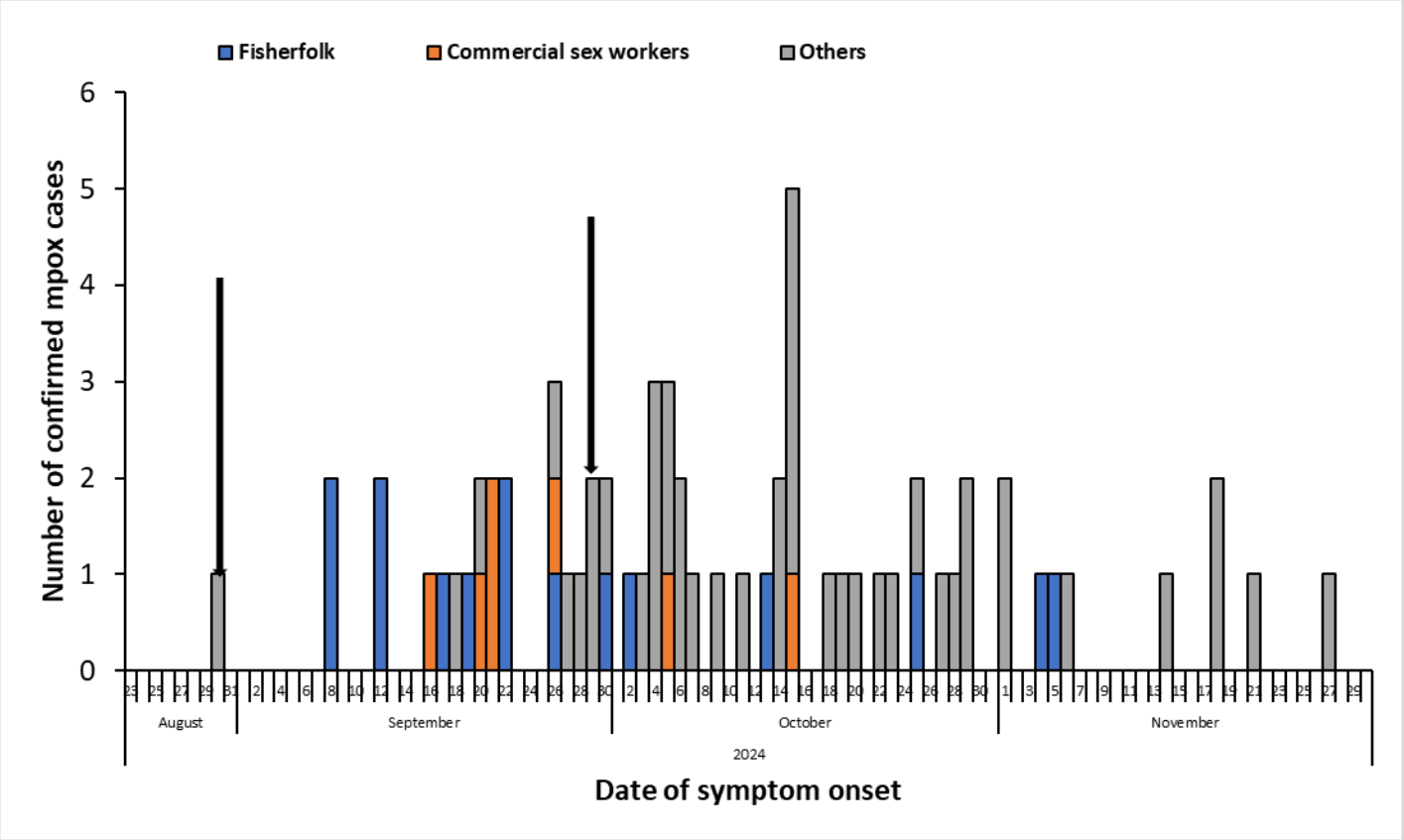

Figure 5: Distribution of cases over time, highlighting the effect of different interventions, Nakasongola District, Uganda, September-November, 2024

Mpox transmission dynamics

During the Mpox outbreak in Nakasongola District, transmission was predominantly driven by close contact, with sexual transmission as the most common mode of spread.

In Lwampanga TC and Lwampanga SC, which accounted for the majority of cases, 60% of transmissions had sexual contact, particularly among CSWs, fishermen, and community members engaging in casual sexual relationships. Household and close physical contact accounted for 30%, including contacts among family members, neighbors, and caregivers. The remaining 10% of cases appeared to be sporadic, with no clear epidemiological link established, suggesting community transmission in the later stages of the outbreak. Transmission hotspots included: Zengebe Landing Site, where interactions between CSWs and fishermen facilitated rapid spread. Bars and shared residences among CSWs in Lwampanga TC, contributing to clustering of cases.

In other sub-counties beyond Lwampanga TC and SC, three distinct clusters were identified. Family-based transmission in Kalungi and Wabinyonyi sub-counties, accounting for about 25% of the cases outside Lwampanga, primarily through close physical contact within households. Sexual contact among fisherfolk and CSWs contributed to around 50% of transmissions in these areas. Twenty-five percent of cases remained unlinked, including students, prisoners, and bar attendants, indicating possible ongoing community transmission.

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Discussion

All confirmed Mpox cases had skin rash or lesions with about half presenting with genital lesions. Females and males were similarly affected. Fisherfolks and CSWs drove transmission in the early phase of Mpox in Nakasongola District. Early transmission was primarily driven by fisherfolk and CSWs, particularly in Lwampanga TC, the most affected subcounty. Transmission routes included sexual contact, close physical contact and possible community transmission.

Fisherfolk and CSWs were identified as key populations driving early transmission due to their high-risk sexual behaviors. Lwampanga TC, with fish landing sites and a high CSW population, had the highest attack rates. Following targeted risk communication and engagement with these groups from late September 2024, there was a decline in Mpox transmission. Risk communication likely promoted safer sexual behaviors, contributing to reduced new infections. Similar interventions have been effective in previous Mpox outbreaks (13).

Human-to-human transmission, particularly through sexual contact dominated the early phase of the outbreak, which has been documented before (14–16). However, household clusters also occurred, likely through close physical contact or respiratory droplets. Sporadic cases without clear epidemiological links suggested community transmission. Notably, four sporadic cases were students, with no evidence of school-based transmission. Between October 9 and November 30, 2024, few cases were reported among fisherfolk and CSWs. During this period, heightened school-based surveillance was implemented, and community alerts decreased from 20 to fewer than 10 per week.

Study limitations: During the field investigations, there was a possibility of recall bias on past behaviors such as sexual contacts and travel history which could have led to inaccurate or incomplete information. However, conducting timely investigations minimized memory decay. There could have been social desirability on engagement in commercial sex work due to fear of stigma and judgment which might have affected the underreporting of transmission by sexual contact. However, we ensured anonymity and confidentiality from the respondents.

Conclusion: Fisherfolk and CSWs, through sexual contact, drove transmission in the early phase of Mpox outbreak in Nakasongola District. Prompt isolation of Mpox cases and targeted risk communication and engagement to fisherfolks and CSWs in Lwampanga TC and SC interrupted transmission among these groups and areas. Transmission to other groups such as students and families in the later phase of the outbreak was likely through close human-to-human contact and respiratory droplets.

We recommended prompt isolation of identified Mpox cases among key populations and students in schools, and targeted interventions such as risk communication and engagement to other affected areas of the country such as Kampala to interrupt further spread of infection.

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

Authors' contributions: DW, AK, EN, HK, BN, JR, MN, MW, RA, AB, KR, SKH, IA, and DO participated in the design, field investigations, data collection, analysis, and interpretation. DW led the writing of the bulletin article. BK, RM, LB, and ARA participated in bulletin writing and review to ensure scientific integrity and intellectual content. All the authors contributed to the final draft of the bulletin.

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Knowledge attitude and practices toward Mpox among healthcare workers in Kasese and Mayuge Districts, Uganda, August-September, 2024

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Summary

Background: On August 2, 2024, Ministry of Health r eported two confirmed cases of Mpox in Kasese District and the disease has continued to spread to other districts including Mayuge, with a cumulative count of 5 confirmed cases and no death. We assessed the knowledge, attitude, and practices (KAP) among healthcare workers (HCW's) about Mpox to inform control and prevention interventions.
Methods: We conducted a cross-sectional study among 339 HCW's from selected health facilities in Kasese and Mayuge districts, August 1–September 30, 2024. We collected data using a pre-tested self-administered questionnaire. Bloom's cut-off ≥80%, 79%-50%, and 49% and below was used to determine adequate knowledge, positive attitude, and good practices toward Mpox.
Results: Out of 339 HCW's, 215 (63%) were female, 253 (75%) were in 18-35 age group, 202 (60%) had adequate knowledge of Mpox, 295 (87%) had heard information about Mpox, 211 (62%) were aware of the ongoing Mpox outbreak in Uganda and 268 (79%) knew Mpox is a viral infection. Most, 165 (50%) listed fellow HCW as the source of health information on Mpox. Majority, 300 (88%) had not received training in Mpox, and 296 (87%) did not know its incubation period. The majority, 270 (80%) had positive attitude toward Mpox, 313 (95%) agreed that they should go to the health facility once they start presenting with Mpox symptoms and 286 (88%) agreed that Mpox is a serious disease with increased infection by direct contact with infected persons. The majority of HCW's, 300 (88%) had poor Mpox practices.
Conclusion: HCW's had adequate knowledge and a positive attitude toward Mpox which showed an opportunity for improvement in their practices which were generally poor. Majority had not received training and had no case definitions at health facility. We recommended training and provision of Mpox information education communication materials to enlighten HCW's knowledge on Mpox during surveillance, response and manage-

Background

Mpox, previously known as Monkeypox is an infectious disease caused by the monkeypox virus, it is a viral infection, zoonotic in nature (1). It causes mortality, case fatality rate 0.2% (283/129,172) among people of all ages through direct contact acquired naturally via skin, mucous membrane and respiratory tract once exposed or in direct physical contact with infected individuals, contaminated materials, or infected animals (2-4). The pathogenesis and clinical presentation of Mpox depend on the route of infectious exposure, the dose, the strain of MPXV, and immune system of the host among others (4). To date, there are still significant uncertainties about the main transmission routes of Mpox, reservoirs, transmissibility, severity, and natural history requiring for more studies on the disease.

Mpox signs and symptoms usually begin within a week but can also start 2–21 days after exposure, lasting up to 2–4 weeks but may last longer among high risk people especially the immunocompromised persons (3, 5). Mpox case fatality may range between 1% - 10% depending on the type of clade and some of the severe complications include: pneumonitis and encephalitis. Clinical characteristics of Mpox vary but include: fever, rashes, lymphadenopathy, headache, malaise, fatigue, anal, genital and oropharyngeal lesions (6). A patient will remain infective until the lesions are crusted over, fallen off or dried (7). Treatment of Mpox is mainly through supportive care although treatments like oral tecovirimat have been used in clinical trials and other countries (8,9). The laboratory confirmation of Mpox is done by testing skin lesion material, oropharyngeal, genital, rectal, urine, semen, saliva for polymerase chain reaction (PCR) confirmation of MPXV infection by detection of unique sequences of viral DNA by real-time polymerase chain reaction (RT-PCR) and/or sequencing (10).

On August 14, 2024, as a result of the upsurge in Mpox cases and increased mortality around the world, World Health Organization (WHO) declared Mpox a Public Health Emergency of International Concern (PHEIC) a day after Africa Centers for Disease Control and Prevention (CDC) had declared it a Public Health Emergency (PHE) of continental security (17).

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On July 24, 2024, the Ministry of Health (MoH) Uganda reported two confirmed cases of Mpox in Kasese District (18). Subsequently, Uganda reported a case in Mayuge District and more case in other districts. We assessed the knowledge, attitude, and practices among healthcare workers, Uganda, Kasese and Mayuge districts, August–September 2024, to inform control and prevention measures.

Methods

Study design and setting: We conducted a cross-sectional study from August 1–September 30, 2024 among HCW's working at selected health facilities in Kasese and Mayuge districts. At the time of this study, the selected health facilities had either registered an Mpox confirmed, suspect case or treated an Mpox patient

Study population and sample size: We conducted the study among 384 healthcare workers (Sample size determined using the Cochran's sample size formula) on a day shift: medical doctors, nurses, midwives, laboratory assistants, laboratory technologist, and interns directly involved in the provision of healthcare service. Healthcare workers who were present on the day shift, directly involved in care of patients, and willingly volunteered to participate in the study were included.

Data collection and study variables: We collected data on socio-demographic characteristics of HCW's, and knowledge, attitudes, and practices on Mpox using a self-administered, structured questionnaire based on previous studies on infectious disease outbreaks: COVID-19 and Ebola and the standard WHO guidance on prevention and control of Mpox (19) (20). We collected data about socio-demographic characteristics, Mpox incubation period, signs and symptoms of Mpox, knowledge on Mpox vaccine, causative agent, prevention methods, mode of transmission, treatment methods, Mpox case definition, type of distribution of Mpox rashes, knowledge of ongoing Mpox outbreak in Uganda, training on Mpox and source of information on Mpox. Others included: severity of Mpox, infection prevention and control, training and mentoring others and supervision. Having adequate knowledge was defined for a healthcare worker scoring above the mean value of the knowledge questions.

Poor knowledge was defined for a healthcare worker who scored below the mean value of the knowledge questions. Positive attitude was defined for a healthcare worker who scored above or equal to the mean value of the attitude questions and having a negative attitude was defined for a healthcare worker who scored below or equal to the mean value of the attitude questions.

Data management and analysis: Data were extracted from the electronic kobo collect tool, cleaned in Microsoft excel and analyzed using Epi Info and STATA. Frequency distribution was performed for categorical variables and were expressed in numbers and percentages. For the 7 knowledge questions, "yes" was indicated as a correct answer and scored 1, and "no or don't know" answers were scored 0. The scores were added to give a total knowledge score that ranges from 0 to 7. HCW's overall knowledge was determined using modified Bloom's cut-off point, adequate knowledge score was between 80% and above (10-15 points) and 79% to 50% for moderate knowledge (5-9 points) and 49% below (0–4 points) for poor knowledge. Regarding attitude, the 7 questions were scored on a 3-point Likert scale (disagree, agree and don't know). The responses were scored 1 for disagree, 2 for agree and 0 for don't know or non-response. The cumulative score for all 7 questions were 0–14 points per HCW's. Overall attitude was categorized, using Bloom's cut-off point, HCW's had a positive Mpox attitude if they scored ≥80% (10-14 points) and poor or negative Mpox attitude if the scored 79% and below (0-9 points). The 6 practices questions were assessed as yes, no, don't know and non-response. "yes" was indicated as a correct answer and scored 1, while "no, don't know and non-response" answers were scored 0. Multiple responses were allowed. The cumulative score for all 6 questions ranged from 0 to 6 points for each participant. Overall practice level was similarly categorized using Bloom's cut-off point of ≥80% (4 above points) to determine good practice and poor practice if the score was between 79% and below (0-3).

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Results

Socio-demographic characteristics of study participants

Of the 426 participants recruited and given questionnaires, only 339 HCW completed the questionnaire with a response rate of 80%. Majority of the HCW's were female 215 (63%), 149 (44%) were married and 199 (61%) had a certificate as the highest level of education. Most of the participants, 157 (47%) were aged 18-28 years, and the mean age of participants was 30.9 (SD ± 9.3) and median 29 years. Nurses were the most respondents 129 (38%) followed by midwives 60 (18%), and 184 (60%) of the HCW's had been in health service for <5 years (Table 1).

Table 1: Social demographic characteristics of healthcare workers, Uganda, Kasese and Mayuge district, Uganda, August–September, 2024

Characteristic	Freq (n=339)	Percent (%)
Age (yrs.)		
18-35	253	75
>=36	86	25
Sex		
Male	124	37
Female	215	63
Marital Status		
Divorced	15	4.4
Married	149	44
Never married	89	26
Separated	6	1.8
Single	75	22
Widow	5	1.5
Level of Education		
Masters	10	3.1
Bachelors	25	7.7
Diploma	92	28
Certificate	199	61
Designation		
Nurses	129	38
Midwife	60	18
Laboratory staff	31	9.1
Medical doctor	41	12
Clinicians	23	6.8
Pharmacist/Dispenser	6	1.8
Radiographer	2	0.6
Others	47	14
Years in health service (n=307)		
<5	184	60
5-10	62	20
>10	61	20

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Knowledge toward Mpox among healthcare workers, Kasese and Mayuge Districts, Uganda, August–September, 2024

Of the 339 HCW's who responded to the questionnaire, 202 (60%) had adequate knowledge of Mpox. The majority of HCW's, 295 (87%) had heard information about Mpox, 128 (62%) were aware of the ongoing Mpox outbreak in Uganda, and 268 (79%) knew that Mpox is a viral infection. Most of the respondents 165 (50%) listed fellow health workers as sources of health information especially on Mpox. The majority 268 (79%) knew the causative agent of Mpox and only 39 (11%) were working at health facilities that had registered an Mpox case. However, 300 (86%) of the HCW's had not received any training in Mpox, and 296 (87%) did not know the incubation period of Mpox. The main sources of information for HCW's included: health facility 165 (50%), followed by radio 140 (43%) and fellow HCW's 136 (42%).

Attitude toward Mpox among healthcare workers, Kasese and Mayuge Districts, Uganda, August–September, 2024

Overall, 270 (80%) of the participants scored 80% and above, and were categorized as having a positive Mpox attitude. The majority of the participants 313 (95%) agreed that they should go to the health facility once they start presenting with Mpox signs and symptoms. The majority of the HCW 286 (88%) agreed that Mpox is a serious disease that could cause death, and 288 (88%) agreed that infection can increase by direct contact with an infected person (Table 2).

Table 2: Attitude toward Mpox among healthcare workers in Kasese and Mayuge district, Uganda, August–September, 2024

Questions (n=339)	Agree n (%)	Disagree n (%)	Don't know n (%)
Mpox is a serious disease	286 (88)	9 (2.1)	30 (9.2)
Mpox disease does not lead to death	57 (17)	220 (67)	52 (16)
Wearing PPE would not protect me from the Mpox virus	77 (23)	208 (63)	44 (13)
Hand wash could protect me from the Mpox virus	252 (77)	39 (12)	37 (11)
I should go to hospital if I have Mpox signs and symptoms	313 (95)	4 (1.2)	12 (3.7)
Mpox infection can increase by overcrowding	279 (85)	11 (3.4)	38 (12)
Mpox infection can increase by direct contact with an infected person	288 (88)	4 (1.2)	35 (11)

Practices toward Mpox among healthcare workers in Kasese and Mayuge Districts, Uganda, August–September, 2024

Overall, 300 (88%) of HCW's had poor Mpox practices. The majority of the HCW's 290 (85%) knew the methods on how to protect themselves and others in case they got infected with Mpox: wearing the necessary personal protective gear, isolating themselves, disinfecting contaminated surfaces (Table 3). However, majority of them 300 (88%) have not been trained or mentored on different aspects of Mpox: mode of transmission, treatment, signs and symptoms, incubation period, causative agent. At health facility, 293 (86%) of the HCW's reported not having or distributed Mpox information education materials (IEC).

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Table 3: Practices toward Mpox among healthcare workers in Kasese and Mayuge Districts, Uganda, August–September, 2024

Questions (n=339)	Correct n (%)	Incorrect n (%)
What is the first thing you would do if you suspected an Mpox case here at the HF?	325 (96)	14 (4.1)
How do you protect yourself and other HCW's from getting infected with Mpox?	321 (95)	18 (5.3)
Have you offered any training or mentorship to other health workers on Mpox?	39 (12)	300 (89)
Have you done any supervision and preparedness activities for surveillance of Mpox at your HF or community?	43 (13)	296 (86)
Have you distributed any Mpox IEC materials?	46 (14)	293 (86)
Have you treated or taken care of any Mpox patient here at the health facility in the past few weeks?	7 (2.1)	332 (98)

Discussion

The majority of healthcare workers had adequate knowledge toward Mpox, majority were aware of the ongoing Mpox outbreak in Uganda, and the causative agent of Mpox. Most of the respondents listed fellow health workers as their sources of health information especially on Mpox. The main sources of information for HCW's was: health facility, followed by radio and obtaining information from fellow HCW's. However, majority of the HCW's had not received any training in Mpox, did not have case definitions at the health facility, and did not know the incubation period of Mpox. The majority of HCW's had positive attitude toward Mpox, agreed that they would go to the health facility once they started presenting with Mpox signs and symptoms, agreed that Mpox is a serious disease that could cause death, and that the infection can increase by direct contact with an infected person. However, majority of the HCW's had poor Mpox practices: neither were they trained or mentored on Mpox nor did they have Mpox information education materials.

In this study majority of the HCW's had adequate knowledge. This finding can be attributed to the awareness of Mpox created by MoH both health and community level given the ongoing Mpox outbreak in the country. The early outbreak in districts like Kasese allowed HCW's to educate themselves on what needed to be done in case they got infected or registered a case at the healthcare workers. Although 60% of them had good knowledge, the number still seems low considering HCW's should be equipped with knowledge on a number of diseases. This finding is similar to those in China where 91% of medical workers had good knowledge of Mpox but the true number of those who were knowledgeable was actually less and 64% of HCW 'sin Algeria with medium knowledge (21) (22). Other countries that have conducted similar studies have reported lower percentages of good knowledge of Mpox among health workers: in Saudi Arabia 48%, Nepal 53% and Lebanese 33% (23) (24). The differences in these studies can also be associated to differences in study setting, perceptions, severity, and study period of Mpox.

This study revealed positive attitude toward Mpox among HCW's. HCW's are called to service even when spread of the disease under surveillance puts their lives at risk. A positive attitude during an outbreak among HCW's goes a long way in reducing transmission of Mpox but nosocomial infections in general. Our findings are in agreement with a study conducted in Uganda among HCW's who had 78% positive attitude toward COVID-19 (25). Their study highlighted an improvement in attitudes among HCW's who went on to learn more about COVID-19 as the outbreak evolved. Other studies show relatively low positive attitudes of Mpox among HCW's: Nepalese 51% and 30% among the general public in Lebanon (24) (26).

Although most HCW's had poor Mpox practices, they knew the different methods of prevention against Mpox.

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This practice is highly expected of them given that control and mitigation of transmission of any disease begins with them. However, these findings are contrary to a study in Uganda which found that HCW's had poor COVID-19 prevention methods and overall only 37% of them had good practices (25). The study highlighted that HCW's continued to gathered in common places knowing very well that this exposed them to COVID-19 at the time (25).

Study limitations: The self-reported approach of responses creates social desirability bias among respondents which we suspect could have also happened in this study. In addition, inherent limitations of the cross-sectional studies cannot be avoided given that snapshot description of knowledge and attitude among HCW's can change over time as outbreaks or interventions unfolds.

Conclusion: Healthcare workers had adequate knowledge and a positive attitude toward Mpox which showed an opportunity for improvement in their practices which were generally poor. Majority had not received training and had no case definitions at health facility. We recommended training and provision of Mpox information education communication materials to enlighten HCW's knowledge on Mpox during surveillance, response and management.

Competing interest: The authors declared no conflict of Interest

Author contribution: JOK: Participated in the conception, design, analysis, and interpretation of the study results, drafted the bulletin; EM participated in data analysis; HK, JN, DW participated in data collection; RM, supervised the outbreak investigation, reviewed the report and bulletin for intellectual content; PE, HTN, SL, ME, BK, ARA reviewed bulletin draft for intellectual content and scientific integrity.

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Mpox outbreak investigation at Sowe Island, Mukono District, Uganda, August–November 2024

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Summary

Background: On November 9, 2024, 1 year and 8 months old female twins residing at Sowe Island in Mukono District tested positive for Mpox. Additionally, many other people presented with similar signs and symptoms at the island. We investigated to establish the magnitude of the outbreak, assess potential exposures, and to recommend evidence-based control and prevention measures.
Methods: We defined Mpox cases as suspected, probable or confirmed cases using the standard case definition by the Ministry of health, Uganda and the World Health Organization. We collected samples from all suspected cases that presented with active Mpox signs and symptoms. We conducted descriptive epidemiology of the cases and carried out an environmental analysis to understand the potential exposures to Mpox.
Results: There were 22 cases including 3 confirmed and 19 probable cases. All were children below 18 years, most were male 12 (55%) and the majority were aged between 5 to 18 years 19 (86%). The median age was 10 years (IQR 6-13). The majority were school going (86%) and attended universal primary school 12(55%). All cases presented with a skin rash, 64% had cough, 59% had fever, and headache (55%). Males (AR=8/100 persons) and children aged 5-18 years (7/100 persons) were the most affected. Transmission of the disease among cases was through day to day social interactions such as playing and sitting together at school or living in the same household.
Conclusion: This was an Mpox outbreak among children possibly transmitted through daily interactions at school and at home. We recommended isolation and treatment of the confirmed cases by the Mukono District health team. Additionally, we recommended infection prevention practices such as hand washing, timely and continuous sensitization of the islanders on public health issues such as Mpox in order to prevent future outbreaks.

Introduction

Mpox formerly known as Monkey pox is caused by an orthopoxvirus and spreads mainly through close contact with someone who has Mpox (1,2). Mpox did not receive international attention until 2022 when it spread beyond the African continent (8,10,11). This led to its declaration as a public health emergency of international concern by the World Health Organization (2,12). On July 24, 2024, Uganda confirmed its first cases of Mpox reported in Kasese District (13). By November 2024, 649 cases had been registered across 45 districts in Uganda with Kampala, Nakasongola, Mukono, and Wakiso being the most affected (14). On November 9, 2024, twins aged 1.8 years old residing at Sowe Island in Mukono tested positive for Mpox. Additionally, many other people presented with similar signs and symptoms at the island. We investigated to determine the magnitude of the outbreak, exposure risk factors, and recommend control and prevention measures.

Methods

Outbreak area: Sowe is a small island of approximately 64 acres of land on Lake Victoria, off the Mpatta subcounty mainland in Mukono District. The island has a dynamic population, an average of 500 people reaching as high as 700 during the busy fishing season. There are 2 primary schools (universal primary school and Crossway primary), both privately owned from nursery to primary six. There are no secondary schools or tertiary institutions. Fishing is the main source of income.
Case definitions and finding: We defined Mpox cases as suspected, probable or confirmed cases using the standard case definition by the Ministry of health, Uganda and the World Health Organization. We line listed cases using the snowball method where individuals in the community with already existing symptoms led us to others. We conducted a descriptive analysis of the cases by age, sex and clinical presentation. We observed the housing, sanitation, health care services and economic activities of the residents of the Island. We collected samples from suspected cases with active signs and symptoms. The samples were shipped to the Uganda Virus Research Institute (UVRI) laboratory for PCR test.

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Ethical considerations: The Ministry of Health authorized this investigation as a response to a public health emergency. The office of the Associate Director for Science at the US Centers for Disease Control and Prevention (CDC) Uganda, determined that this investigation did not involve human subject research and that its primary intent was public health practice. Additionally, we sought approval from Mukono District authorities to conduct the outbreak investigation. We obtained verbal informed consent from the respondents and ensured confidentiality by interviewing participants in privacy and keeping their data in a password protected computer accessed only by the investigating team.

Results

Descriptive epidemiology: We identified 22 cases, all were children below 18 years, mostly male, 12 (55%) and aged between 5 and 18 years, 19(86%). The median age was 10 years (IQR 6–13). The majority were school going, 19(86%) and attended universal primary school, 12(54%) (Table 1). The overall attack rate= 7/100. Males were the more affected (8/100) than females (6/100). Children ages 5–18 years were more affected (7/100) compared to children below 5 (4/100).

Table 1: Distribution of cases by gender, age group, and occupation during an outbreak of Mpox, Sowe Island, Mukono District, Uganda, August-November, 2024

Characteristic (n=22)	Frequency	(%)
Gender		
Male	12	(55)
Female	10	(45)
Median age (years) [IQR]	10	(6-13)
Age group (years)		
<5	3	(14)
5-18	19	(86)
Occupation		
School going	19	(86)
Universal P/S	12	(54)
Crossway P/S	7	(32)
Non- school going	3	(14)

All cases presented with a skin rash, some had cough (64%), fever (59%), and headache (55%) (Figure 2).

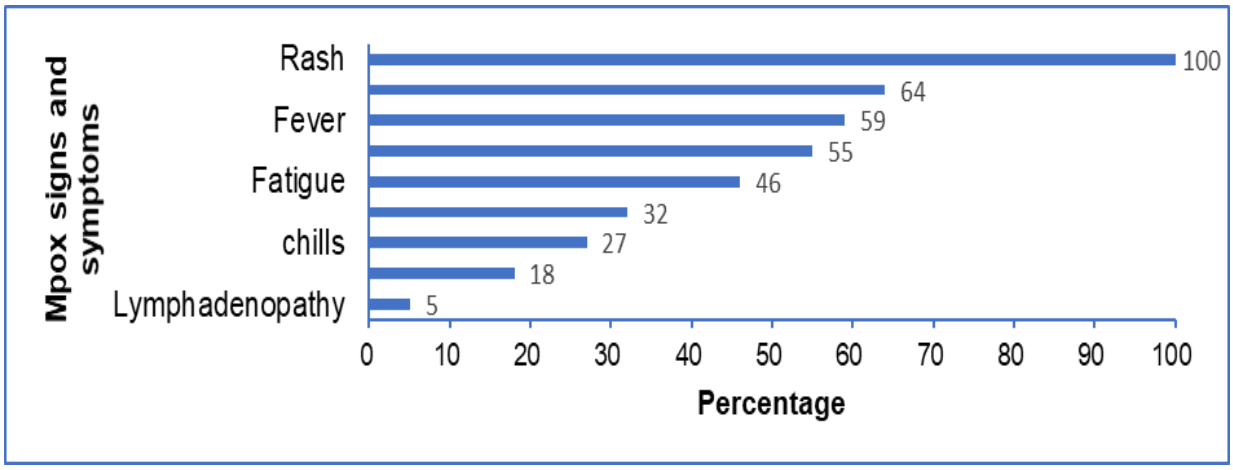

Figure 2: Clinical presentation of Mpox cases, Sowe Island, Mukono District, Uganda, August–November 2024

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During our community case search, we identified Case CM (Figure 3) as one of the early cases that was still actively showing symptoms and whose sample turned positive. CM's probable exposure was during her 3 days' stay at a relatives' place in Kampala where she shared a bed with another girl who had symptoms. On returning to the island, she noticed a body rash and embarked on self-medication. The disease possibly spread through the close interaction that people at island had especially children. The children at the Island played freely and entered each other's home. The subsequent probable cases played together at school or sat next to each other in class. Twin1 was possibly exposed by her brother who returned from boarding school at the mainland Kampala, with lesions. The twins were observed being carried by older children who resided at the school. Twin 2 eventually got symptoms in October 2024 along with other children.

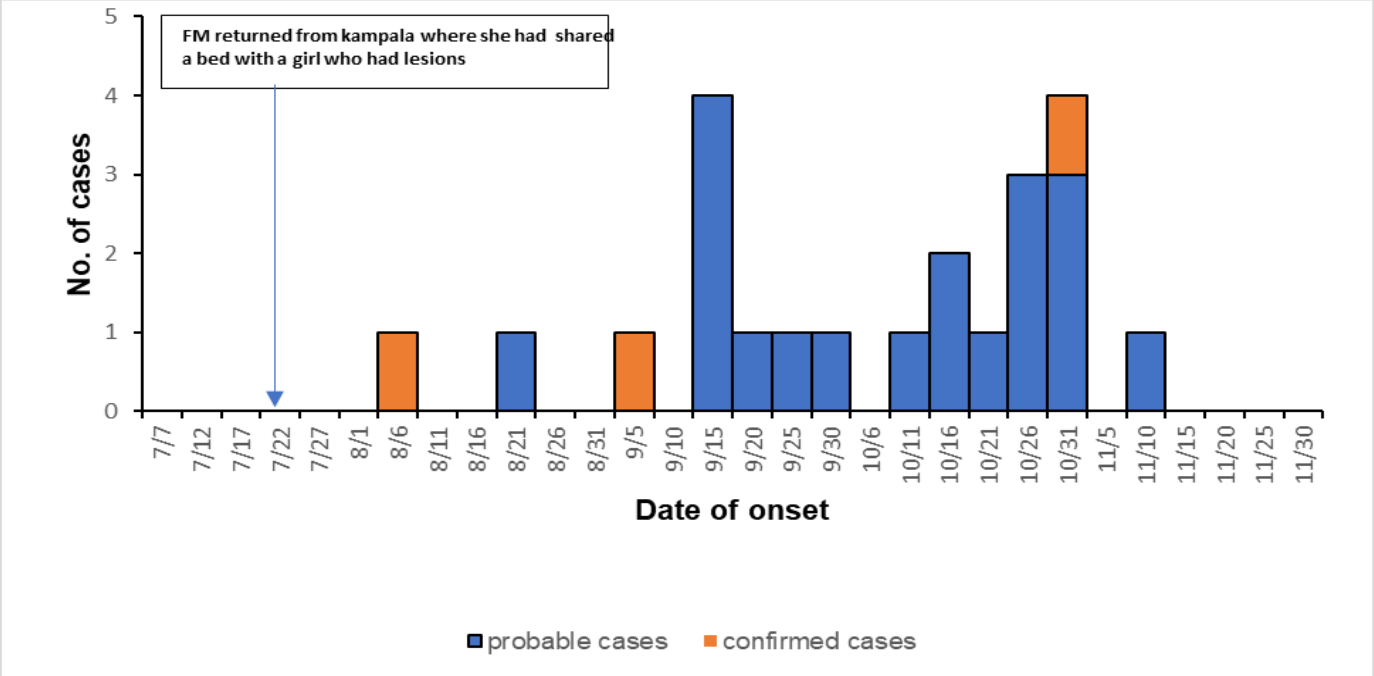

Figure 3: Distribution of both Mpox suspected and confirmed cases over time at Sowe Island, August–November 2024.

Discussion

All the cases were children. The disease was imported by those who had travelled to already affected districts on the mainland. The majority of the cases were male and school going. There were no severe cases or hospitalization.

Mpox spread on the island was only among children and given the overall attack rate, the disease was found not to be highly contagious among the children. This is similar to another study in France where children and adolescents had few secondary transmission of Mpox (15). The majority of the affected children at the island were in school. The school setting is one of the drivers of community transmission of infectious diseases due to the close contact through activities such as playing that happen in schools (16). Though studies show low transmission rates in schools, school based interventions such as isolation of cases are believed to be instrumental in preventing and controlling community transmission of Mpox (15,16). However, for the case of sowe island, transmission and recovery occurred with no major targeted interventions as the community went on with their usual life routines.

There was a possibility that undetected transmission occurred at island probably because of lack of awareness about the disease. It was noted that the disease had started in August and was only confirmed in November, 2024.

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This was similar to what was seen during the 2022 Mpox global transmission where numerous transmission occurred and even recovered before being detected by health care authorities (17)

Study limitations: The outbreak happened on a small island where the team had to cross the lake on a daily basis with limited transportation options, this access restriction may have delayed response to the outbreak. Additionally, there was possible misclassification of cases as there were no health care facilities or qualified personnel to diagnose cases that had symptoms. The cases ended up healing without diagnoses and treatment.

Conclusion: The outbreak was likely imported to the island by individuals who came from the mainland areas of Kampala where there was an already existing Mpox outbreak. The outbreak occurred only among children below 18 years, mostly males and those who attended the two schools located at the island. We recommended continuous case identification through the village health team at the Island in addition to regular sensitization of the occupants on public health issues. We recommended follow up on all confirmed cases and their evacuation to the treatment unit as they could potentially infect other people.

Public health actions: We conducted an Mpox awareness meeting with the island's local council leadership and encouraged them to guide the community to report any person with signs and symptoms.

Conflict of interest: None

Authors Contribution

JN, EM, DA and AN participated in the investigation. All authors contributed to the write up and review of the bulletin. JN wrote the drafts of the bulletin. BK, RM, LB, AN, ARA reviewed the bulletin and ensured scientific integrity.

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Rapid containment of an Mpox outbreak, Uganda, Masindi Prison, June-October 2024

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Summary

Background: On 6 October 2024, the Ministry of Health (MoH) Uganda was notified of an Mpox outbreak in Masindi Prison. Given the high-risk nature of correctional facilities, where overcrowding and limited healthcare access facilitate disease spread, an investigation was conducted to determine to describe the outbreak, trace its source, evaluate containment measures, and recommend strategies for control and prevention.
Methods: We defined suspected and confirmed cases as per the MoH Uganda case definitions. Cases were identified through health record reviews, active case finding, and environmental assessments. We conducted contact tracing to establish links to potential sources. To describe the outbreak, we performed descriptive analysis of the cases.
Results: Two confirmed and 26 suspected Mpox cases were identified in Masindi Main Prison, with no reported deaths. The outbreak originated from two detainees arrested in Kijunjubwa Sub-County, an area with suspected community transmission, and transferred to the prison on 6 August 2024. The first suspected case appeared on 9 August, and the last on 20 October 2024. Despite high inmate density, the outbreak was officially declared contained on 14 November 2024, following two full incubation periods without new cases. We achieved rapid containment within 72 days through prompt implementation of infection control and surveillance measures. These included daily triage, active case finding, onsite sample collection, isolation of cases, improved hygiene practices, disinfection of shared items, provision of PPE, movement restrictions, staff training, and risk communication.
Conclusion: Early detection and swift containment measures limited Mpox spread in Masindi Prison. The rapid setup of surveillance, case isolation, improved hygiene, and onsite sample collection ensured timely intervention. Additional measures, including movement restrictions, disinfection of shared spaces, and staff sensitization, helped control the outbreak. Strengthening surveillance, improving prison sanitation, enforcing hygiene protocols, and enhancing pre-transfer screening for inmates are essential to mitigating future outbreaks in prison settings.

Background

Mpox, formerly known as monkeypox, is a zoonotic viral disease closely related to small pox but milder (1). Mpox was first identified in humans in Democratic Republic of Congo (DRC) in 1970 and periodically poses as a public health challenge due to its capacity for both zoonotic and human-to-human(2). Contributing factors to the spread of Mpox has been attributed to key drivers of Mpox transmission include environmental and socio-economic factors, such as climate change, habitat land use shifts, increased population density, cross-species contact, and globalization as well as its transmission through transnational tourism, animal movements and trade(2, 3).
On July 24, 2022, WHO declared Mpox a global public health threat after a May 2022 outbreak that demonstrated its capacity to spread worldwide beyond its endemic regions in Central and West Africa (4). Uganda confirmed its first Mpox cases of the year in Kasese District, marking the beginning of a new wave of infections. On October 6, 2024, Masindi Prison reported its first two cases, drawing attention to the vulnerability of prison settings in facilitating disease transmission. Shortly after, Hoima District confirmed its first Mpox case on October 20, 2024.
Prison environments are characterized by high population densities, limited healthcare access, restricted ventilation, and frequent inmate transfers, all of which contribute to an increased risk of infectious disease outbreaks. We assessed the extent of the outbreak in Masindi prison and district, profiled confirmed cases, and evaluated public health interventions aimed at curbing transmission.

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Methods

Outbreak area: The outbreak occurred in Masindi District, located in Uganda's Western Region. The district borders Nwoya to the north, Kiryandongo to the east, Nakasongola to the southeast, Kyankwanzi to the south, Hoima to the southwest, and Buliisa to the west all of which had experienced a surge of Mpox cases. We focused the investigation on Uganda Government Prison Masindi, a high-security correction facility in Central Division, Masindi Municipality served by Masindi Prison Health Center III. The prison holds a large number of inmates under congested conditions, where prisoners share sleeping areas, have limited healthcare access, and experience restricted movement, increasing the risk of disease outbreaks. The facility consists of 18 blocks and two wards, each accommodating an average of 80 to 160 prisoners. New prisoners undergo triage at the ward near the entrance and spend 24 hours in the holding unit before admission.

Case definition and finding: Case identification involved reviewing prison health facility records, conducting active surveillance, and interviewing healthcare personnel. The study applied the World Health Organization's suspected, probable, and confirmed case definitions for Mpox.

Laboratory investigations: We collected samples from suspected cases, including skin lesion swabs, oropharyngeal swabs, genital and rectal swabs and saliva. Laboratory analysis was conducted using real-time polymerase chain reaction (RT-PCR) to detect Mpox virus-specific DNA sequences.

Descriptive epidemiology: We constructed an epidemic curve to determine the distribution of Mpox cases over time and described the distribution of signs and symptoms of the inmates fitting the case definition.

Environmental assessment: We visited the prison to conduct a physical inspection. We examined the overall layout of the facility, paying close attention to living conditions, available space, and hygiene infrastructure. Observations were made regarding how inmates were housed, their access to hygiene materials, and the state of sanitation facilities. We measured the capacity of the prison in comparison to the actual number of inmates. We reviewed the spacing arrangements and identified how inmates were accommodated within the available space. Special attention was given to whether isolation areas were designated for suspected cases.

We examined the availability of essential hygiene materials, such as soap and clean water. We also reviewed the waste management system, inspecting sanitation facilities, including latrines, to assess their adequacy in maintaining cleanliness and preventing environmental contamination. The assessment included a review of infection prevention and control measures in place.

This involved examining protocols for isolating suspected cases, assessing hygiene practices among inmates, and evaluating the overall sanitation management strategies implemented within the facility.

Ethical considerations

The Ministry of Health of Uganda gave the directive to investigate this outbreak. We also sought permission from the commissioner of Prison Services who gave us approval to investigate this outbreak within the prison system. The Office of the Associate Director for Science at the US Centres for Disease Control and Prevention (CDC) Uganda determined that this research did not involve human subject research and that its primary intent was public health practice or disease control.

Results

Descriptive epidemiology

We identified a total of 28 cases: 26 suspected, 2 confirmed, and no deaths. Although the Mpox outbreak in Masindi Prison was officially detected in early October 2024 when two cases were confirmed through laboratory testing on 26 September and 3 October retrospective case tracing revealed that symptoms had first appeared in early August. These earlier cases were among newly admitted detainees, indicating that transmission had begun weeks before confirmation. The outbreak was ultimately traced back to Kijunjubwa Sub-County, where suspected community transmission was ongoing. This conclusion was supported by an active case search that identified additional cases in the community and confirmed Kijunjubwa as the likely source of introduction (Figure 1).

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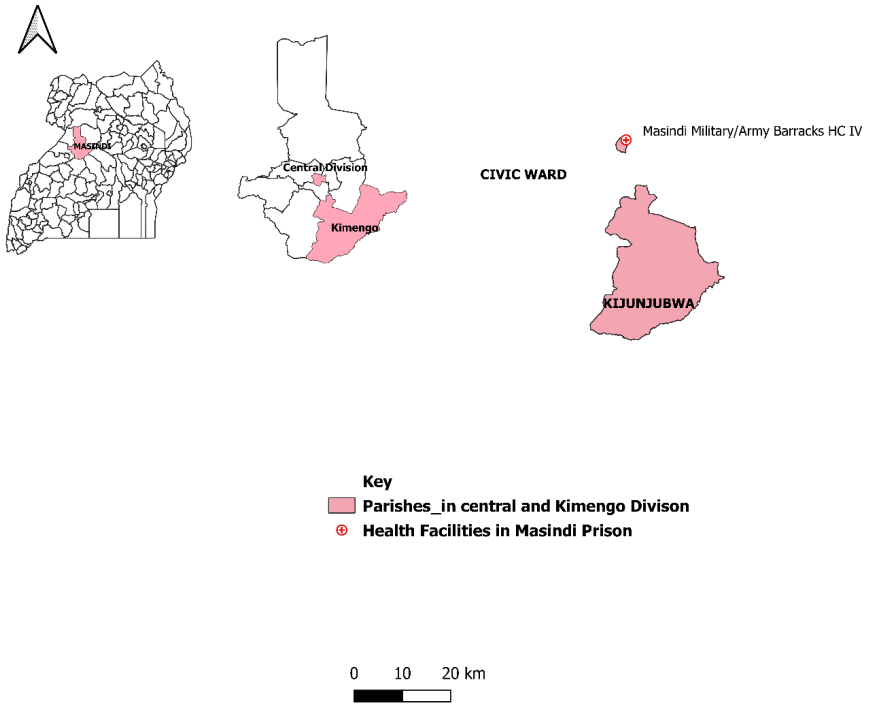

Figure 1: location of Kijunjubwa parish and Masindi Military HCIV in Civic ward Kimengo and Central Subcounty in Masindi district Uganda

On August 3, 2024, two individuals, identified as Detainee X and Detainee Y, were arrested for theft at Royal Ranch in Kijunjubwa Sub-County and detained at Kijunjubwa police post. Three days later, on August 6, 2024, they were transferred to Masindi Main Prison as newly admitted inmates.
One of them had previously worked at Royal Ranch as a cattle keeper, where he reported seeing a few people in the area with an unexplained rash illness before his arrest. Although neither detainee showed symptoms upon arrival at the prison, both developed a rash, fever, and body aches by August 8, 2024. The medical records show that the prison health team diagnosed and treated them for chicken pox.
First suspected inmate case: On August 10, 2024, an 18-year-old inmate, referred to as Detainee T, developed an itchy rash, fever, and swollen lymph nodes. It was discovered that Detainee T had close contact with Detainee X and Detainee Y, including sharing clothing without washing it. This marked the first suspected case of Mpox within the general prison population.
Subsequently, additional 23 suspected cases emerged among inmates as of October 2024, reinforcing the likelihood that the virus had already been circulating within Masindi Prison before detection.

On October 6, 2024, a prisoner E, who had recently been transferred from Masindi Prison to Nakasongola Prison developed Mpox symptoms on October 8,2024. His case was confirmed on October 9,2024 through PCR testing, raising concerns that Masindi Prison had been experiencing undetected transmission before his transfer. This event triggered a full review of cases at Masindi Prison previously diagnosed as chicken pox.

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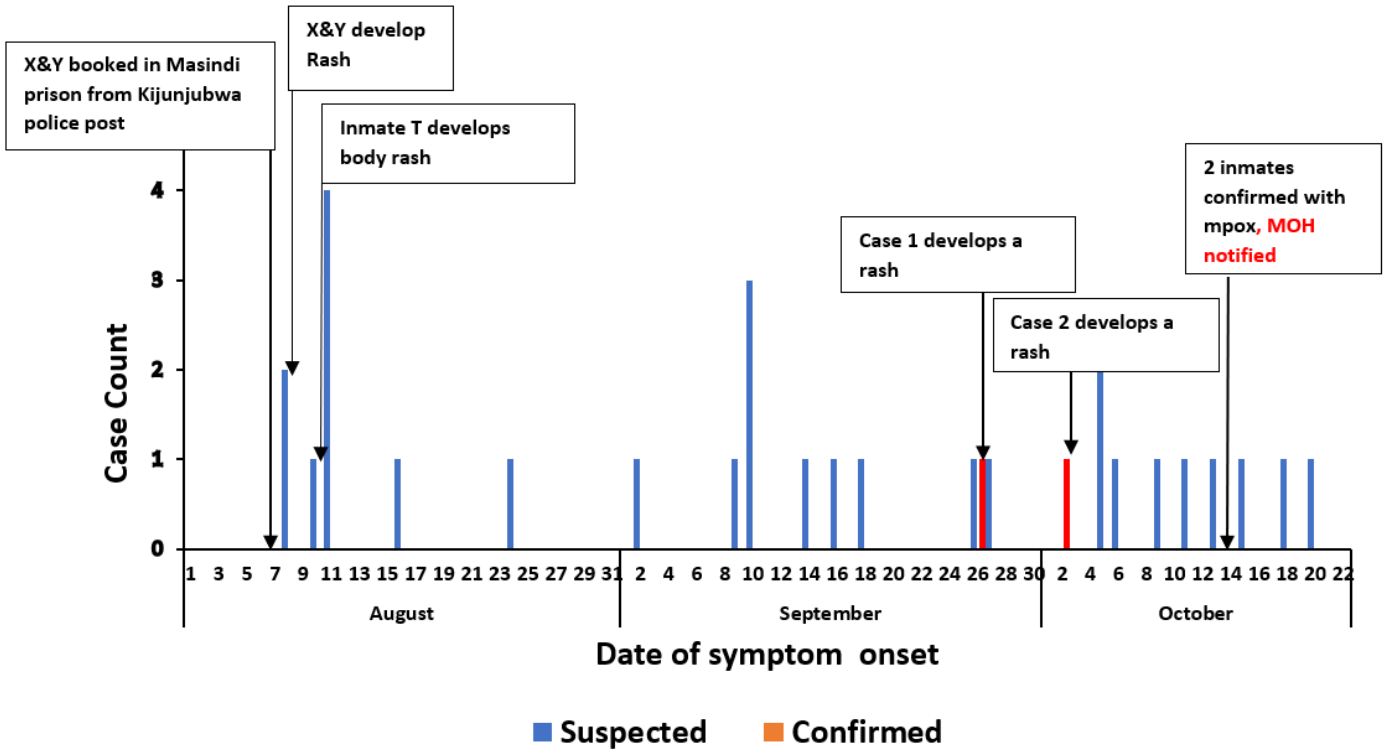

Figure 3: Distribution of Mpox cases by the date of onset of symptoms in Masindi District, Uganda, Aug–Oct, 2024 (n = 290)

Following the confirmed case from the inmate transferred from Masindi to Nakasongola, the doctor in charge of Masindi Prison suspected an Mpox outbreak, when on September 26, 27 and October 3, 2024, suspects developed a generalized itchy rash. In response, samples were collected from three suspected inmates on October 10, 2024.On October 14, 2024, two cases were confirmed through PCR testing, officially verifying the presence of Mpox in Masindi Prison. These cases were later referred to as Case 1 and Case 2 and Ministry of health was notified of an outbreak of Mpox in Masindi prison.
The first confirmed case of Mpox in Masindi Prison, Case 1, began experiencing prodromal symptoms, including headache, fever, and chills, on September 26, 2024. By September 27, 2024, an itchy rash appeared on his face, later spreading to the arms, back, chest, and scalp. A sample was collected on October 9, 2024, and results confirmed Mpox on October 14, 2024. By October 16, 2024, the patient was healing and requested discharge from isolation.
The second confirmed case, Case 2, had a more severe presentation. On October 3, 2024, the inmate developed prodromal symptoms, including headache, fever, chills, sore throat, and sensitivity to light. By October 3, 2024, a papular rash appeared on the abdomen, later bursting to release fluids and spreading to other body parts, including the mouth, penis, and anus, causing anorectal pain. A sample was collected on October 9, 2024, and results confirmed Mpox on October 14, 2024. By October 16, 2024, he was recovering, though a few new lesions were still appearing.

Containment measures and outbreak control
Early containment efforts were challenged by delayed recognition of the outbreak. Although symptomatic cases began to emerge in August and September, they were initially misdiagnosed, and the outbreak remained undetected. Limited diagnostic capacity and overlapping symptoms with other rash illnesses hindered early identification. It was not until early October, following a confirmed Mpox case in a transferred inmate, that a formal investigation was launched and containment efforts were initiated.
From October 10 to 15, immediate response measures were implemented. An isolation unit was established within the prison to separate confirmed and suspected cases from the general population. Daily triage was introduced to screen inmates for Mpox symptoms, and active case finding was initiated across the facility. Onsite sample collection was also organized to facilitate rapid testing and confirmation of suspected cases.

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From October 23 onward, movement restrictions were enforced to prevent cross-contact between different groups of inmates. Prison staff received training on Mpox identification, isolation protocols, and infection prevention measures. Risk communication and hygiene promotion activities were scaled up, increasing awareness among inmates and staff and reinforcing adherence to the containment guidelines.

The last suspected case was identified on October 20, and no new cases were reported thereafter. The outbreak was officially declared contained on October 31, 2024, after one full incubation period passed without additional cases. Continued monitoring and preventive measures remained in place. Overall, the outbreak was successfully contained within 72 days of the first exposure, demonstrating the effectiveness of rapid, coordinated containment interventions in a high-risk correctional setting.

Discussion

The Mpox outbreak in Masindi Prison, which resulted in 28 identified cases (26 suspected and 2 confirmed), was successfully contained within one incubation period from the last confirmed case. This outcome is significant given the vulnerability of prison environments to infectious disease outbreaks due to overcrowding, restricted movement, poor ventilation, and inadequate healthcare infrastructure (5). The WHO recognizes prisons, detention centers, and refugee camps as high-risk environments for Mpox transmission and emphasizes the need for enhanced infection control measures (6). In contrast to outbreaks such as COVID-19 and tuberculosis, which have proven difficult to control in correctional settings due to delayed detection and weak health systems (7), the Masindi outbreak was curtailed quickly through early identification, isolation, and coordinated response. The rapid response in Masindi was driven by effective surveillance, timely sample collection, and strong collaboration between prison authorities, the Ministry of Health, implementing partners, and the Central Public Health Laboratory (CPHL). These measures aligned with the WHO strategic framework, which stresses the importance of isolating suspected Mpox cases, implementing minimum infection prevention and control (IPC) standards, and integrating correctional facilities into national surveillance systems (6). The prison adopted key interventions such as routine screening, risk communication, staff training, and improved sanitation. These efforts mirror successful strategies used in controlling respiratory outbreaks like COVID-19 and influenza in other countries, such as South Korea and Taiwan, where strict quarantine, testing, and early interventions helped limit spread (5, 8). However, challenges like limited space for isolation, inadequate PPE, and under-resourced prison health systems have undermined containment efforts in other regions, including Latin America and the United States (9).

Importantly, investigations traced the likely source of infection to Kijunjubwa Sub-County, highlighting the risk of disease introduction into prisons through incoming detainees. High inmate turnover and transfer without adequate screening increase the likelihood of similar outbreaks(10). To prevent future transmission, correctional facilities must adopt sustained prevention strategies, including systematic pre-admission screening, improved IPC infrastructure, and training for prison health workers to identify and manage cases early (6, 7). Long-term measures should also include vaccination strategies, STI screening, and health education focused on high-risk behaviors, including condom distribution, as recommended in the WHO Mpox guidelines (6). Strengthening these systems will help ensure a more comprehensive and sustainable approach to disease prevention in prison settings.

Study limitations: There was also potential for recall bias regarding travel history and close contacts, as inmates may have had difficulty recalling events accurately. Social desirability bias and fear of stigma especially around sexual behavior could have led to underreporting. The prison environment itself may have limited privacy and disclosure. However, the team conducted timely interviews and ensured confidentiality to encourage honest responses.

Conclusion: This Mpox outbreak likely began in early August 2024, introduced by two detainees transferred from Kijunjubwa Sub-County, an area with ongoing community transmission. All cases were male inmates who presented with classic Mpox symptoms such as fever, rash, and lymphadenopathy. Transmission had started weeks before the official detection due to early misdiagnosis as chickenpox. Rapid implementation of control measures including isolation, daily triage, improved hygiene, staff training, and active case significantly reduced further spread.

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Despite the crowded and high-risk environment, we successfully contained the outbreak within 72 days. To prevent future outbreaks in correctional settings, we recommend routine pre-admission screening of new inmates, continuous training of prison healthcare staff, and sustained surveillance systems within prison facilities. Strengthening infection prevention infrastructure, integrating prisons into national outbreak preparedness plans, and ensuring timely risk communication will be essential to managing emerging public health threats in similar high-risk environments.

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

Authors' contributions: JL, EM, EOO, CT, FM and FM participated in the design, field investigations, data collection, analysis, and interpretation. JL led the writing of the bulletin article. BK, RM, and ARA participated in bulletin writing and review to ensure scientific integrity and intellectual content. All the authors contributed to the final draft of the bulletin.

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Application of 7-1-7 matrix in a One Health context during the first anthrax outbreak in Kanungu district, Southwestern Uganda, September 2024

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Summary
Background: In 2021, Uganda adopted the 7-1-7 framework which stipulates outbreak detection in 7 days, notification in 1 day, and completion of early response actions in 7 days. We used the 7-1-7 approach to assess response to the first known anthrax outbreak in Kanungu District following its confirmation on September 17, 2024.
Methods: We used the 7-1-7 metrics to document the dates of emergence, detection, notification, and completion of early response actions. We held discussions with the district leadership, health workers, and community members to establish key dates and facts, and to identify bottlenecks and enablers. Qualitative data were organized into themes to capture bottlenecks and enablers.
Results: The disease emerged in animals on June 15, 2024 and was detected after 85 days. In humans, the time from emergence (June 26, 2024) to detection was 77 days. The district One Health Team was notified 1 day after detection. Early response actions were jointly initiated after 5 days and completed in 13 days for human health, and in 14 days for animal health. Enablers for immediate notification included presence of a real-time One Health communication platform for health workers. Bottlenecks included weak zoonotic disease surveillance characterized by understaffing, low suspicion index for anthrax, and weak coordination with private health facilities.
Conclusion: Response to the first known anthrax outbreak in Kanungu District met only 1 (notification) of the 3 the 7-1-7 timeliness metrics because of the presence of a real-time one health communication platform. There was delayed detection and response largely due to low suspicion index among health workers and weak zoonotic disease surveillance. The district health team should strengthen One-Health and event-based surveillance at community level to enhance early detection and response activities to avert human fatalities and economic losses.

Introduction

With the increased globalization, it is imperative that any public health emergencies be identified and dealt with in time in order to minimize morbidity and mortality through timely implementation of disease prevention and control measures [1]. The 7-1-7 framework is recommended as a standard tool for assessing timeliness of response to public health emergencies. It stipulates detection of public health emergencies within 7 days from date of emergency, one day for a notification to me made to the authority responsible for action, and 7 days for completion of early response activities[11, 12].

Anthrax is a priority zoonotic disease in Uganda, targeted for multisectoral collaboration in surveillance and response [10, 14]. Despite this, outbreaks of anthrax continue to occur in different regions of the country, with a number of districts experiencing repeated or sustained anthrax outbreaks while some districts experienced anthrax outbreaks for the first time [15-20]. Kanungu District experienced its first ever anthrax outbreak in September 2024. The outbreak was associated with 111 animals that died suddenly, 90 cases of human anthrax including 4 confirmed cases and 6 deaths. We assessed the timeliness of detection, notification, and response to the first anthrax outbreak in Kanungu District, using the 7-1-7 metrics to identify bottlenecks, enablers, and lessons learned in managing outbreak of a priority zoonotic disease in a rural district in Uganda.

Methods

Outbreak setting: Kanungu District is located in Kigezi region, Southwestern Uganda. It is home to some sections of the Bwindi Impenetrable National Park (BINP) in the south and the Ishasha sector of the Queen Elizabeth National Park (QENP) in the North and North East.

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The district has several livestock farms, including communal grazing areas, and is a gate-way for movement of livestock and livestock products to the Democratic Republic of Congo (DRC). The district has a District One Health Team (DOHT), which has been in place for about 2 years.

Study variables and data collection: To establish facts on key dates and events, we interviewed health workers, field veterinarians, and community members using the 7-1-7 metrics. We noted the dates of emergence in both animals and humans. We also noted the dates when the outbreak was detected, when notification to the district health authorities was done. Additionally, we documented the dates early response was initiated and when the 7 and early response actions were completed.

Participants were assured that their participation was voluntary and that there would be no negative consequences for declining to participate or withdrawing from the investigation. Data collected did not contain any individual personal identifiers and information was stored in password-protected computers, only accessible to the investigation team.

Results

7-1-7 assessment

Detection in animal health: From the earliest sudden animal deaths until when anthrax was first recorded in the system at Mburameizi health center III, there was a time gap of 85 days. The initial animal deaths on farm X were never reported to the veterinary health team. Some farms vaccinated their livestock against clostridial infections, as anthrax was not suspected in animals until it was detected in humans. From interviews with key informants we found that this was the first time to interface with anthrax and this contributed to its late detection by the surveillance system.

I studied about anthrax in school, but I have never seen any animal that has died of anthrax. (Farm manager-)

Animals have been dying from time past, and they are usually healthy-looking animals. In such cases, we usually suspect black quarter. In fact, around August, some farmers vaccinated their herds against black quarter after it had been confirmed by lab on one of the farms" (District Veterinary Officer, KDLG)

Detection in Human Health: The earliest date of symptom onset was June 27, 2024. This outbreak was later detected on September 9, 2024, at Mburameizi Barracks Health Center III. Considering that there were already reports of livestock deaths in in neighboring farms, admission of patients with suggestive symptom for anthrax raised suspiscion, after 74 days. One of the case persons reported history of rearing livestock, and slaughter and trade of meat of animals that had died suddenly. One of the case persons was quoted thus:
I used to head about anthrax from old people, but at my age, I have never seen anyone with the disease (*case person Mburameizi subcounty)*

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Notification: The notification was immediate (one day). Once anthrax was detected at Mburameizi HC III, a notification was sent to the district One Health Team, who are regularly in touch with the health facility through the district surveillance focal person The district has a whatsapp group that is meant for surveillance. Health related information is regularly posted by different health workers from different health facilities in the district.

"*We have a whatsapp group where different health workers all-over the district share information. This helps us to know what is happening in different facilities in real time" (In-Charge, Mburameizi Health Center III).*

Response: Early response actions were completed in 14 days. As more cases were reported at the same health facility, the DHT was promoted to follow up on these alerts. Once the alerts were verified, a district laboratory team was dispatched to pick samples from these case persons on September 14, 2024. This marked initiation of the early response activities, 5 days after notification.

Time characteristics and 7-1-7 assessment of an anthrax outbreak in Kanungu district, Southwestern Uganda, September-October 2024

Laboratory results were received by the district on September 17, 2024, 3 days after sample collection, and anthrax outbreak as confirmed in humans. Immediately the district team launched a joint (One Health) risk communication campaign by means of radio talk shows.

"*Anthrax is a serious disease that can cause serious disruption in the livelihood of communities. Once it was confirmed we had to act fast" (District Health Officer, Kanungu DLG).*

The national rapid response team was deployed to support case investigation and other response activities on September 22, 2024. A mass livestock vaccination against anthrax was launched on September 23, 2024, targeting the most affected subcounties, completing the early response actions (Table 1).

Discussion

Our study assessed the timeliness of detection, notification, and response to the first known anthrax outbreak in Kanungu District in South Western Uganda, right from the community level, to the district level. The disease was detected after 85 days in animals and 77 days in humans. A notification was immediate (one day) and early response actions were completed in 14 days. We identified 3 missed windows of opportunity during which the outbreak could have been detected earlier. The district had a real-time One Health communication platform that facilitated immediate notification. The assessment revealed a major gap in routine surveillance in the veterinary sector and the one health framework in the outbreak district. We highlight the importance of strengthening district One Health teams for integrated surveillance and early detection of public health emergencies, and the need for capacity building to enhance health worker suspicion index particularly regarding zoonotic diseases.

Study limitations: All the data collected were qualitative, heavily relying on the respondents to recall events as far as 3 months back. This could have led to inaccuracies in the data collected, likely leading to wrong estimation of dates of onset, the number of cases, or the interpretation of information provided by the respondents. We therefore used different investigation team members to independently analyze the obtained from respondents. Further validation was obtained by corroboration with information obtained from district leadership, and quantitative data obtained from outbreak investigation and response.

Additionally, the 7-1-7 approach has not yet been launched in the Uganda Animal health surveillance system. Our aim was to highlight it its utility in a One-Health context, in support of strengthening collaboration between the One Health sectors during routine disease surveillance.

Public health actions: Following our preliminary result dissemination, one implementing partner supported training of Over 500 VHTs Event Based Surveillance (EBS) at community level. Additionally, about 1000 teachers were sensitized about anthrax, and about 8,000 animals vaccinated against anthrax within the first 7 days of response initiation.

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Table 1: Time characteristics and 7-1-7 assessment of an anthrax outbreak in Kanungu district, Southwestern Uganda, September-October 2024

	Event/Narrative	Date	Classification	Time taken	Target	Target met
Detection window 1	Animals introduced at farm A	6/14/2024	-			
	First animal deaths	6/16/2024	Emergence – Animal health			
	More animal deaths reported in different farms	6/24/2024	-			
Detection window 2	Earliest human symptom onset, sough care in a drug shop	6/27/2024	Emergence – Human health			
	More animal deaths in different farms	June 24 – Aug 21				
Detection window 3	Animal deaths on farm B linked to clostridial infections	8/22/2024	-	85 - Animal health		
	More animal deaths reported in different farms	Aug 23 – Sep 8	-	74 - Human health	7	No
	First case reported at Mburameizi HC III	9/9/2024	Detection			
	District One Health team notified	**9/9/2024**	**Notification**	1 day	1	Yes
	Human samples collected	9/14/2024	Early response initiated			
	Lab confirmation of Anthrax in humans	9/17/2024			7	
	Risk communication and social mobilization by district One Health team	9/17/2024				
	Provisional quarantine instituted on livestock and livestock products	9/18/2024	Early response			No
	NRRT deployed	9/22/2024				
	Active case search initiated	9/23/2024				
	Livestock vaccination campaign launched	9/23/2024	Early response completed	10 days		
	Lab confirmation of Anthrax in animals	10/7/2024				

Conclusion: This study reiterates the critical importance of timely detection and response to a zoonotic disease outbreak. Response to the first known anthrax outbreak in Kanungu District a border district experiencing a major public health threat of anthrax for the first time met only 1 (notification) of the 3 the 7-1-7 timeliness metrics owing to a real-time communication platform. There was delayed detection and response largely due to, low suspicion index among health workers and weak zoonotic disease surveillance.

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support and guidance during the process of reaching different farms, health facilities, and communities to obtain information that led to the 7-1-7 assessment. We also acknowledge the
district political leadership led by the Resident District Commissioner (RDC) who was also the head of the District Task Force (DTF). The RDC continuously supported risk communication and implementation of control measures that
eventually led to the end of the outbreak. Special appreciation goes to Dr Scott Kellerman and the entire team at Bwindi Community Hospital, Buhoma for the time you dedicated to participate in this assessment, including availing your vehicle and fuel.

Conflict of Interest

The authors declared no conflict of Interest

Author Contribution: HK led the conception,
design, analysis, and interpretation of the study results, and drafted the bulletin. HK, CM and BA participated in assessment, interpretation of results and review of the draft bulletin article. BMR and TA participated in the validation of the data obtained and interpretation of results. RM and HNN supervised the assessment and reviewed the bulletin for intellectual content, HTN, BK, SK, ARA reviewed the bulletin draft for intellectual content and scientific integrity.

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Trends and distribution of acute flaccid paralysis cases and their outcomes among children below 15 years, Uganda, 2016–2023

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Summary

Background: Uganda, in line with the global efforts to eradicate polio by 2026 identifies, investigates, and reports acute flaccid paralysis (AFP) cases among children <15 years for timely detection of polio. We analyzed secondary data from 2016–2023 to describe the demographic and clinical characteristics of AFP cases; determine trends and spatiotemporal distribution, and assess physical and laboratory outcomes of AFP cases in children under 15 in Uganda.
Methods: We conducted a retrospective study of secondary data archived in the EPI laboratory at UVRI of all AFP case samples tested in the country from January 2016 to December 2023. Our outcome variables included demographic characteristics, clinical characteristics, non-polio AFP (NPAFP) rates, physical and laboratory outcomes of AFP cases. Descriptive information was interpreted using frequencies, proportions and rates. We compared NPAFP rates across study years using trend analysis in STATA.
Results: A total of 6,409 AFP cases were cumulatively reported in the 8-years period. Of these, 5,837 (97%) were true AFP cases and 5,687 (89%) were detected early. The majority (59%) were children <5 years and most (58%) were males with a median age of 3 years (IQR: 1-7 years). Clinically, the majority (90%) of case-patients were identified from the community (not hospitalized); (91%) had fever at onset of paralysis, (86%) had paralysis progress in 3 days, (80%) had asymmetrical paralysis. and (57%) had only one limb of their bodies paralyzed. Of 5,744 case-patients, 4,960 (77%) had received 3+ doses of oral polio vaccine and 158 (3%) had not received any dose. In each year of the study period, 99.9% of all the districts in the country had achieved an NPAFP rate of ≥1.0/100,000 children <15 years. Of the 6,405 samples tested, 154 (2%) were suspected to have poliovirus and 8 (0.1%) had non-polio enterovirus (NPENT) plus poliovirus suspected. Of the 823 case-patients followed-up after 60 days, 250 (30%) still had residual paralysis present, 5(0.6%) were lost to follow-up and 9 (1%) had died before follow-up.
Conclusion: The AFP surveillance system in the country is active and well distributed as evidenced by 99.9% of all districts each year of the 8-years study period reporting at least one AFP case. However, the targeted NPAFP rate of ≥3/100,000 children <15 years was poorly achieved in some districts throughout the study period. This calls for a need to continuously support both the passive and active surveillance systems in these districts

Introduction

Acute Flaccid Paralysis (AFP) is defined as the sudden onset of weakness/floppiness or paralysis in any part of the body of a child below 15 years of age (1). The primary purpose of AFP surveillance is to increase the chances of early detection of any variant of poliomyelitis in populations of children below 15 years. It is also one of the strategies in the efforts to globally eradicate polio worldwide by 2026 (2). Poliomyelitis is a viral infection caused by Polio virus (PV) of genus Enterovirus (3). Acute flaccid paralysis and muscle weakness from polio infection manifests when the virus attacks the central nervous system, preferentially infecting and destroying motor neurons (3).

One of the indicators used in AFP surveillance is the non-polio AFP (NPAFP) rate. It is an indicator of surveillance sensitivity. NPAFP rate represents the number of non-polio AFP cases that are detected annually per 100,000 population aged <15 years (10). Where polio is present or where polio is a threat, this target, the objective is to detect at least two cases of non-polio AFP each year for every 100,000 children <15 years in all at-risk and outbreak countries, and to detect at least three cases of non-polio AFP each year for every 100,000 children under 15 years in endemic countries and outbreak-affected areas, where Uganda belongs (10). For every AFP case identified and investigated after 14 days from onset of paralysis (late case), a mandatory 60 days follow up has to be conducted by a trained medical/clinical officer (10).

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Uganda conducts both passive and active surveillance for AFP among children <15 years as a notifiable condition. From this, hundreds of AFP cases are identified, investigated and reported through the country's surveillance system annually. We described the AFP case-patients by person, place, and time characteristics; and their physical and laboratory outcomes following the 60 days follow up.

Methods

Study setting, design, and data source: We conducted a retrospective study using AFP surveillance data generated at the Uganda Virus Research Institute (UVRI) from the entire country, January 1, 2016 to December 30, 2023. As per the integrated disease surveillance and response, a true AFP case was defined as any child under 15 years of age with a sudden onset of flaccid/floppy paralysis on any limb identified within the 60 days from onset of paralysis, or a person of any age in whom polio is suspected by a clinician. An early AFP case on the other hand was defined as one identified within 14 days from onset of paralysis. A late AFP case was one detected after 14 days from onset of paralysis. A silent district was one that had not reported any single AFP case in a calendar year contributing a Non-Polio Acute Flaccid Paralysis (NPAFP) of 0/100,000 children <15years.

Study variables, data abstraction, and analysis: We abstracted data about the demographic variables including age, sex; clinical variables including hospitalization status of the case-person, fever at onset of paralysis, progression of paralysis within 3 days after onset of paralysis, and nature of the paralysis, number of doses received from either the routine or SIAs if vaccinated. We categorized the paralyses into four types based on the limbs affected that is monoplegia, hemiplegia, diplegia and quadriplegia.

The dataset was entered into EpiInfo and STATA software for analysis. We summarized the demographic and clinical characteristics, laboratory and physical outcomes of the AFP case-patients using frequencies and percentages. To demonstrate the trends and temporal-spatial distribution of AFP case-patients over the study period, we calculated the annual NPAFP rates for each year. We calculated the annual NPAFP rate as number of reported NPAFP cases <15 years in a year divided by the total number of children <15 years of age in that year multiplied by 100,000. We utilized projected under 15 years population estimates for each year from Uganda Bureau of Statistics (UBOS) as denominators.

Comparison of NPAFP rates across years within the study period was done using trend analysis in STATA. Choropleth maps were drawn to show temporal-spatial distribution of NPAFP rates in districts using QGIS software.
Ethics approval: Our study utilized routinely aggregated surveillance data with no personal identifiers complied and archived at the Uganda Virus Research Institute. The Uganda Public Health Fellowship Program is part of the National Rapid Response Team and has been granted permission to access and analyze surveillance data in the DHIS2 and other data such as survey and field investigation data to inform decision-making in the control and prevention of outbreaks and public health programming. Additionally, the Ministry of Health has also granted the program permission to disseminate the information through scientific publications. We stored the abstracted dataset in a password-protected computer and only shared it with the investigation team.

Results

Demographic and clinical characteristics of Acute Flaccid Paralysis case-patients among children <15 years, Uganda, 2016–2023

A total of 6,409 AFP cases were cumulatively reported in the 8-years period. Of these, 5,837 (97%) were true AFP cases and 5,687 (89%) were detected early. Median age of case-patients was 3 years (IQR: 1-7 years); the majority (59%) were children <5 years and males (58%).
In terms of clinical history, the majority (90%) of case-patients were identified from the community (not hospitalized). Of the 6409 case-patients, 5816 (91%) had reported fever at onset of paralysis, 5,476 (86%) reported that paralysis had progressed in 3 days and 5,097 (80%) had asymmetrical paralysis. The majority (57%) of case-patients had only one limb of their bodies paralyzed (monoplegia). Of the 4,548 case-patients, 533 (12%) had received an injection before onset of paralysis. Of the 5,744 case-patients who had revealed their OPV vaccination history, 4960 (77%) had received 3+ doses and 158 (3%) had not received any dose (Table 1).

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Table 1: Demographic and clinical characteristics of Acute Flaccid Paralysis case-patients among children below 15 years, Uganda, 2016–2023

Demographic and clinical characteristics of AFP cases	Mean proportion	
N=6409	**N**	**(%)**
True AFP	5,837	97
Early cases	5,687	89
Late cases	722	11
Demographic characteristics		
Age (years)*		
<5 years	3,801	59
≥ 5 years	2,608	41
Sex		
Female	2,706	42
Male	3,703	58
Clinical characteristics		
Hospitalization status		
Yes	431	10
No	3,913	90
Clinical history		
Fever at onset of paralysis	5,816	91
Paralysis progressed in 3 days	5,476	86
Paralysis Asymmetrical	5,097	80
Type of paralysis		
Monoplegia	3,682	57
Right Hemiplegia	525	8
Left Hemiplegia	662	10
Upper Diplegia	218	3
Lower Diplegia	1,157	18
Quadriplegia	165	3
Any Injection given before paralysis (n=4,548)		
Yes	533	12
No	4,015	88
Vaccination status (n=5,744)		
Zero dose	158	3
1–2 doses	626	10
3+ doses	4,960	77

*Median age 3 years (IQR: 1-7 years)

Trends and temporal-spatial distribution of Acute Flaccid Paralysis case-patients among children <15 years, Uganda, 2016–2023

The national annual NPAFP rate was ≥3.0/100,000 children <15 years in 5 out of the 8 study years with an average of 3.4/100,000 children <15 years in the 8-years study period. There was a noted decrease in the NPAFP rate from 3.6/100,000 children <15 years in 2016 to 2.7/100,000 children <15 years with no statistically significant trend (p=0.8), (Figure 1).

Greater than 50% of all districts each year except in 2020, throughout the study period had achieved the global NPAFP rate target (≥3.0) for an endemic and outbreak prone country. In each year of the study period, 99.9% of all the districts in the country had achieved an NPAFP rate of ≥1.0/100,000 children <15 years (Table 2 and Figure 2).

Laboratory and physical outcomes of Acute Flaccid Paralysis case-patients among children <15 years, Uganda, 2016–2023

Of the 6,405 samples tested, 154 (2%) were suspected to have poliovirus and 8 (0.1%) had Non-polio enterovirus (NPENT) plus poliovirus suspected. The majority (86.2%) of the samples tested negative.

Of the 823 case-patients followed-up, 250 (30%) still had residual paralysis present, 5 (0.6%) were lost to follow-up and 9 (1%) had died before follow-up. The majority (67.9%) had made complete recovery with no residual paralysis present.

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Table 2: Non-polio Acute Flaccid Paralysis rate per 100,000 children below 15 years performance at districts level, Uganda, 2016–2023

Year	<15 years population[β]	Number of Districts*	True AFP cases	National Annual NPAFP Rate	Districts with NPAFP ≥3.0		Districts with NPAFP <1.0		Silent District (s)	
			N=5837	n/100,000	N	(%)	N	(%)	N	(%)
2016	19,030,648	112	679	3.6	69	(62)	8	(0.07)	1	(0.01)
2017	19,647,524	116	621	3.2	66	(57)	2	(0.02)	1	(0.01)
2018	20,281,924	116	701	3.5	79	(68)	2	(0.02)	0	(0)
2019	20,931,456	128	573	2.7	119	(93)	8	(0.06)	0	(0)
2020	21,594,820	135	456	2.1	51	(38)	23	(0.2)	2	(0.01)
2021	22,272,224	135	1,208	5.4	119	(88)	1	(0.01)	0	(0)
2022	22,962,368	135	955	4.2	101	(75)	3	(0.02)	0	(0)
2023	23,664,160	135	644	2.7	107	(79)	4	(0.03)	0	(0)

* *Number of districts: These kept changing as new districts were created*

β *Population estimates from Uganda Bureau of Statistics (UBOS)*

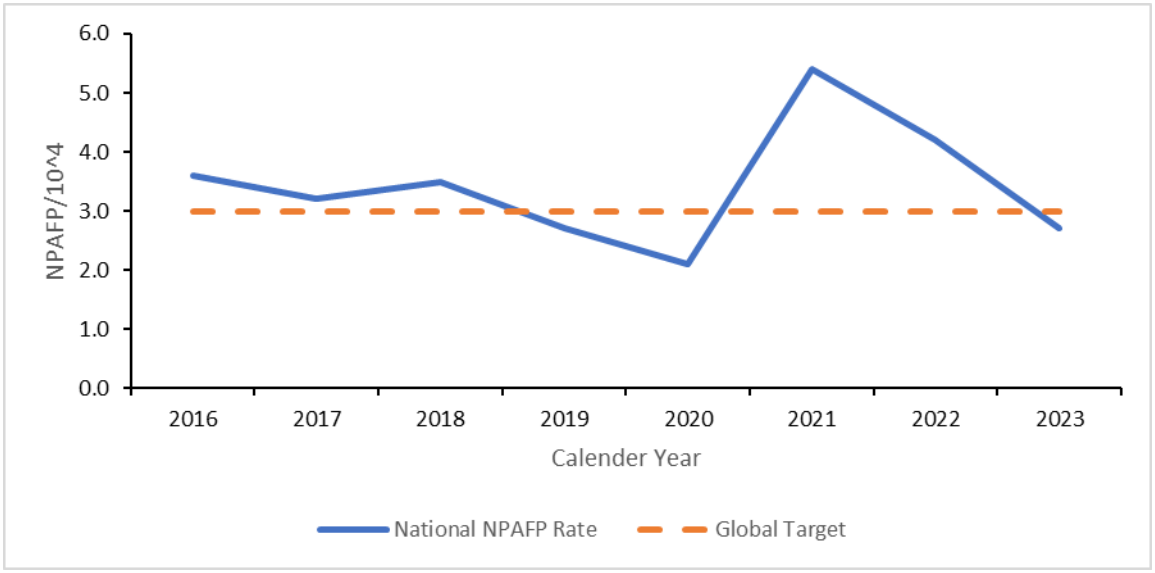

Figure 1: Trends of Non-polio Acute Flaccid Paralysis rates per 100,000 children below 15 years by the districts of Uganda, 2016–2023

Discussion

In our study, the majority of case-patients were children <5 years of age and males by sex. Clinically, greater than three quarters of all case-patients had reported fever at onset of paralysis, had paralysis progress in 3 days, had asymmetrical paralysis and had received more than 3 doses of OPV. For each year of the study period except in 2020, greater than half of all the districts had attained an NPAFP rate greater than the recommended global NPAFP rate (≥3.0) for an endemic and outbreak prone country.

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There was no significant trend in the national annual NPAFP rate throughout the 8-years study period. The majority of stool samples from case-patients tested negative and only 2% were suspected for polio. Less than half of the followed-up case-patients 60 days later had residual paralysis and less than 2% had either died or were lost to follow up.

The majority (59.3%) of cases in the 8-years period were children <5 years of age and most (57.8%) were males by sex. These findings are consistent with those reported in a large dataset study in East and South Africa, also in Ghana, Nigeria and Bangladesh (12, 13, 14, 15). Infants and children <5 years who are not yet toilet-trained and also play in dirty environments are more at risk for contracting polio. This is because polio is most often spread from poor hygiene practices. This includes poor handwashing practices and ingestion of food or water that is contaminated by faeces (17). Therefore, a surveillance system such as this that captures a majority of AFP cases among this age group has more chances of early detection, reporting and investigation of a polio infection.

The majority (91%) of the cases had reported fever at onset of paralysis, (86%) reported that paralysis had progressed in 3 days, (80%) had asymmetrical paralysis and of the 5,744 case-patients who had revealed their OPV vaccination history, 4960 (77%) had received 3+ doses. Similar documentation was noted in studies conducted in Zambia and Ethiopia (21, 22). This signifies that our case-patients were actual AFPs cases and that there was good clinical history capture of the cases by the surveillance team. This good documentation is also important for follow up of contacts of such cases and for final classification by the National Polio Expert Committee (NPEC) (20).

The majority (90%) of case-patients were identified from the community (not hospitalized). Similar findings were reported in a study in Zambia (18).This underpins the importance of community-based surveillance (CBS) including the utilization of community health structures like village health teams (VHTs) and community extension workers (CHEWs) to support AFP surveillance. The World Health Organization guides that CBS is a key method to access hard-to-reach areas and communities that are not reached by the regular AFP surveillance system.

Community-based surveillance is particularly useful in settings or areas at high risk of undetected poliovirus transmission or at risk of new outbreaks following importation or vaccine-derived poliovirus (VDPV) emergence (20).

The national annual NPAFP rate was ≥3.0/100,000 children <15 years in 5 out of the 8 study years with an average of 3.4/100,000 children <15 years in the 8-years study period. Other studies had similar findings with average annual NPAFP rates being above the WHO recommendation including in Zambia, Ethiopia, Ghana, Uganda and Bangladesh (21,22,13, 23,18). Overall, the country achieved the required NPAFP rate of ≥3.0/100,000 children <15 years in the 8 years period which signifies a sensitive surveillance system in an endemic and outbreak prone country. The drop in the rate noted in 2019 and 2020 is largely attributable to disruption in surveillance and health services caused by the COVID-19 pandemic (21).

Greater than 50% of all districts each year except in 2020, throughout the study period had achieved the global NPAFP rate target (≥3.0) for an endemic and outbreak prone country. In each year of the study period, 99.9% of all the districts in the country had achieved an NPAFP rate of ≥1.0/100,000 children <15 years. Another study in Uganda had similar findings though the researchers used the ambitious national target of ≥4.0/100,000 children <15 years (21). In October 2006, Uganda was declared polio free after 10 years of not reporting any indigenous cases of polio (22). But since then there have been pockets of outbreaks of polio in different parts of country, most being imported from the neighboring countries and from environmental surveillance. For this reason, the country is still considered endemic and outbreak prone and is recommended by WHO to have an NPAFP rate of ≥3.0 per 100,000 population of children <15 years per annum (20). Despite some districts not achieving the required NPAFP rate (≥3.0), these findings are indicative of a sensitive AFP surveillance system in the country.

Of the 6,405 samples tested, 154 (2%) were suspected to have poliovirus and 8 (0.1%) had NPENT plus poliovirus suspected. Poliovirus is the most sought cause of paralysis among children <15 years of age but there are other etiologies too.

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Poliovirus is of genus enterovirus, the spinal type presents with asymmetric paralysis that most often involves the legs and the bulbar polio leads to weakness of muscles innervated by cranial nerves (3). Several studies have as well implicated non-polio enteroviruses (NPENT) in AFP including enterovirus 71 (EV-A71), enterovirus-D68 (EV-D68), Japanese encephalitis and West Nile virus (6, 7, 8, 9). This implies that these enteroviruses are circulating among the Ugandan communities and causing paralysis. Therefore, it is important to have definitive laboratory tests to pinpoint the specific enteroviruses for easy management

Of the 823 case-patients followed-up, 250 (30%) still had residual paralysis present, 5(0.6%) were lost to follow-up and 9 (1%) had died before follow-up. Many studies have shown similar findings (10, 11, 13). According to WHO, a case that has inadequate stool specimens (late case) and has residual paralysis after 60 days of onset of paralysis or the patient is lost to follow up or dies within 60 days of symptom is classified as compatible with polio. Presence of such cases that are compatible for polio implies possibility of presence of actual polio virus variants and surveillance should keep the vigilance and investigate all AFP cases diligently.

Study limitations: Some variables had missing data elements for example, of the 6409 case-patients reported, 29% had not answered the question on having had an injection before onset of paralysis. Also, there could have been misclassification bias during entry of the primary data which is hard to adjust in secondary data. However, standard operating procedures were used in entry of this data which could have reduced presence of such bias.

Conclusion: The AFP surveillance system in the country is active and well distributed as evidenced by a large proportion of AFP being detected early and nearly all districts each year of the 8-years study period reporting at least one AFP case. The majority of case-patients identified were true AFP cases; most were detected from the community, had received >3 doses of OPV and had only one limb of their bodies paralyzed. A few case-patients were compatible for Polio. However, the presences of such case-patients underpin the importance of a continued surveillance for AFP to improve the chances of early detection of actual polio cases.

For districts that consistently failed to achieve the required NPAFP rates, we recommend the f ollowing as measures to improve identification, investigation and reporting of AFP cases;
i) Intensify active case search for AFP in both health facilities and communities. This can be done by utilizing existing surveillance structures in the health facilities and communities such as health facility/health sub-district surveillance focal persons, village health team members; ii) Absorb and integrate private health facilities including physiotherapy and massage centers as well as other informal points of health care such as traditional healers, bone setter in surveillance for AFP. Many AFP cases seek for care; iii) Intensify community mobilization and sensitization for AFP surveillance. Findings from our study highlight that the majority of AFP were not hospitalized. This means that these cases were detected in the community. It is therefore important to have the community members involved in active identification and reporting of any AFP in their communities.

There was a lot of missing data on some important variables, for example, of the 6409 case-persons reported, only 4,548 of them answered the question on having had an injection before onset of paralysis. To mitigate such, it is important for surveillance officers to use standard case investigation forms and make sure that they are filled completely.

Conflict of interests: The authors declare no conflict of.

Authors' contributions: EOO conceptualized the study idea, obtained data, analyzed it, and wrote the manuscript. IM, FN, SO, BSN, MB, PE, ET, AK, HT, RM, BK, and ARA participated in editing and reviewing the bulletin article to ensure scientific integrity and intellectual content. All the authors contributed to the final draft of the bulletin.

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Table 1: Study faciliies by level and expected tests

The test type was considered based on the following assumptions; health facility conducted all the tests on the national menu at least once in the review period (none reporting and a total of 0 tests done in the review period indicated test type

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Trends and distribution of Leprosy cases, Uganda, 2020–2024, tracking progress towards elimination

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Summary

Background: Leprosy is targeted for eradication worldwide. In 2021, the World Health Organization instigated a new Global Leprosy Strategy, termed "Towards Zero Leprosy". However, Uganda still reports ≥1 case/1,000,000 population. We described the trends and distribution of leprosy cases, in Uganda, 2020 to 2023, and assessed progress toward elimination.
Methods: We conducted a descriptive analysis of leprosy surveillance data abstracted from the District Health Information System (DHIS2), Uganda, 2020-2023. Incidence rates of leprosy cases were calculated by age, sex, Grade 2 Disability (G2D), region, and district. To assess the significance of observed trends, we used the Mann-Kendall test.
Results: During 2020–2024, 1,899 leprosy cases were reported, with an overall incidence of 49 per 1,000,000 population. The most affected group was those >15 years (13 per 1,000,000); incidence was equal between genders (9 per 1,000,000). Of the cases, 86% were multi-bacillary, 14% pauci-bacillary, and 23% had G2D. Incidence peaked in 2022 (13 per 1,000,000) and was lowest in 2020 (6 per 1,000,000), showing a non-significant upward trend (p=0.2207). The West Nile Region had the highest incidence (56–280 per 1,000,000), with Obongi District in the West Nile Region reporting the highest G2D rate (99 per 1,000,000).
Conclusions: Uganda's progress toward leprosy elimination is facing challenges, with ongoing cases and delayed diagnoses as indicated by the high G2D rates. The high incidence in the West Nile Region highlights the need for targeted interventions. Further studies are needed to explore the underlying factors contributing to the persistent incidence, especially in the most affected districts.

Background

Leprosy, a chronic infectious disease caused by *Mycobacterium leprae*, primarily affects the skin, peripheral nerves, upper respiratory tract, and eyes. Delayed diagnosis and older age worsen the progression of physical deformities associated with the disease(1). Leprosy has a lengthy and varied incubation period, typically averaging 5 years but potentially extending up to 20 years before symptoms appear(2). Leprosy primarily spreads through direct or indirect contact between infected individuals and healthy people (3). The World Health Organization (WHO) classifies patients for treatment purposes into two groups: paucibacillary (PB) with up to five skin lesions and multibacillary (MB) with six or more. This classification helps guide treatment and assess the risk of leprosy reactions and nerve damage(7).

Leprosy remains endemic in over 120 countries globally, with approximately 200,000 new cases reported annually(4). Global elimination of leprosy as a public health issue—defined as a prevalence of <1 per 10,000 population—was officially achieved in 2000, following World Health Assembly resolution 44.9, and in most countries by 2010(5).

Despite intensive community-based contact tracing and improved adherence support, leprosy remains endemic in Uganda, with 40% of districts reporting at least one case to the National Tuberculosis and Leprosy Program (NTLP) as of 2016(8). The incidence of grade 2 disability surged to 1.72 per million, over three times the NSP target (10). We described the trends and distribution of leprosy cases, Uganda, 2020–2024 to inform targeted control interventions.

Methods

Our study utilized data generated from the entire country. Leprosy diagnosis and treatment is free in Uganda. The hospitals receive suspected leprosy cases from health facilities called Health Centers II, III, and IV (MOH, 2015).

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Six health facilities, five general hospitals, and one HC III, currently have leprosy treatment centers. These include two facilities in Eastern Uganda, three in Northern Uganda, and one in Western Uganda. In 2021, the Ministry of Health launched the Community Awareness, Screening, Testing and Treatment to end TB and Leprosy in Uganda Campaign (CAST), an enhanced case-finding approach for the un-diagnosed TB and leprosy cases (including those missed during the COVID-19 pandemic period) towards combating community TB and leprosy transmission and end TB and leprosy in Uganda.

We conducted a descriptive analysis of leprosy surveillance data abstracted from the district health information system from 2020 to 2024. We abstracted data about leprosy cases by age, sex, type of leprosy, and disability grades. We calculated the incidence of leprosy by person, place, and time. We also abstracted data on the proportions of leprosy by type, that is, multibacillary and G2D to observe the trends in the country over time from 2020 to 2024.

We drew maps to demonstrate the spatial distribution of leprosy cases using Geographic Information Systems (GIS). To visualize trends, we plotted line graphs showing annual leprosy incidence against time. Data analysis was performed using R software, with trend significance evaluated using the Mann -Kendall test, while Sen's slope test was employed to determine the direction of the trend.

This analysis used surveillance data from DHIS2. This data is aggregated with no individual patient identifiers. However, we sought and obtained permission from the MoH to use the data. The US Centers for Disease Control and Prevention (CDC) also provided the non-research determination for non-human subjects, which waives the need for a full Institutional Review Board. We collected de-identified data. All data was stored in password-protected computers and access was limited to the study team.

Results

Descriptive epidemiology of leprosy cases in Uganda, 2020-2024

Overall, the incidence of leprosy was 49/1,000,000 in the population over the five years. The incidence of leprosy increased from 6/1,000,000 population in 2020 to 13/1,000,000 population in 2022. The incidence later declined to 6/1,000,000 population in 2024. We identified a total of 1,899 leprosy cases from 2020 to 2024, of which 13% involved children < 15 years of age, 55% were females, 86% were multi-bacillary, and 23% presented with Grade 2 Disability (G2D) (Table 1).

Table 1: Person characteristics of Leprosy cases notified in Uganda, 2020-2024

Variable	2020	2021	2022	2023	2024	Total
Annual cases n (%)	234(12)	467(26)	581(30.5)	342(18)	275(13.5)	1899(100)
Sex						
Male n(%)	123(14)	218(25.5)	254(30)	144(17)	113(13.5)	852(45)
Female n(%)	111(11)	249(24)	327(31)	198(19)	162(15.5)	1047(55)
Type of leprosy						
MB n(%)	211(13)	358(22)	531(32)	298(18)	238(14.5)	1636(86)
PB n(%)	23(9)	109(41)	50(19)	44(17)	37(14)	263(14)
G2D n(%)	92(21)	86(19.5)	101(23)	83(19)	78(18)	440(23)
Age in years						
<15 years n(%)	29(11)	54(21)	72(28)	56(22)	47(18)	258(13)
≥15 years n(%)	210(13)	413(25)	509(31)	286(17)	228(14)	1646(87)

G2D: Grade 2 disability; PB: Pauci-bacillary; MB: Multi-bacillary

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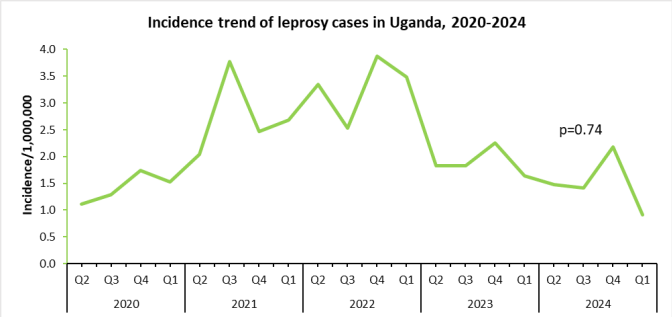

Figure 1a) Incidence trend of Leprosy cases, Uganda, 2020-2024

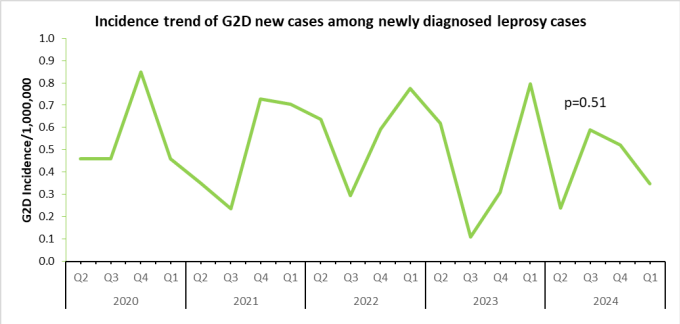

Figure 1b) Incidence trend of G2D cases among newly diagnosed leprosy cases in Uganda, 2020-2024

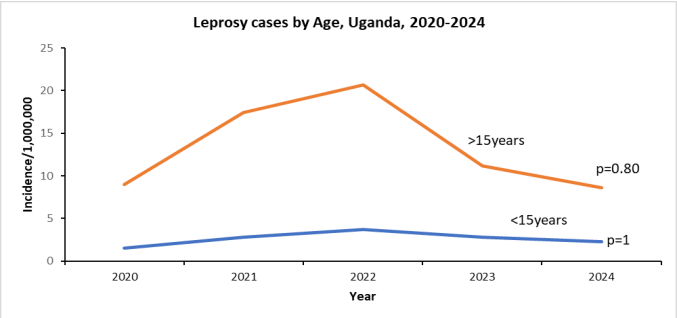

Figure 1c) Incidence trend of leprosy cases by age, Uganda, 2020-2024

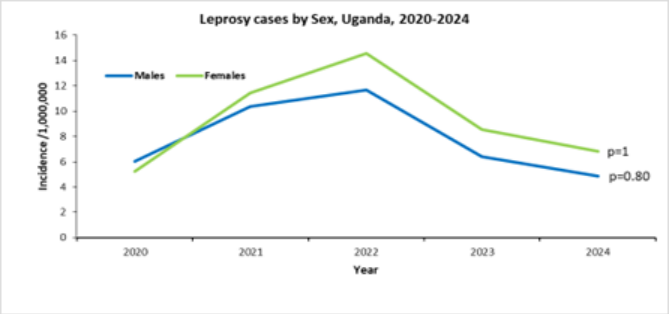

Figure 1d) Incidence trend of Leprosy cases by sex, Uganda, 2020-2024

There was an insignificant increase in the incidence of leprosy cases from 2020, with cases peaking in 2022 (p=0.74). Leprosy incidence increased from 2/1,000,000 population in 2020 to 4/1,000,000 population in 2021 and 2022 (Figure 1a).

Similarly, there was a consistent rise and fall in the incidence of G2D cases reported throughout the five years, although this trend was not statistically significant(p=0.51). G2D cases peaked with 1/1,000,000 people reported every July to September (Q3) for the five years (Figure 1b).

There was an insignificant rise in the incidence of leprosy in both adults above 15 years and children below 15 years from 2020 to 2022 and later a drop in the incidence of leprosy from 2022 to 2025(p=0.80 and p=1, respectively). The age group > 15 years was the most affected with a mean incidence of 13 cases/1000,000 population. Leprosy incidence was highest in 2022 across both males and females as well as both age groups (Figure 1c).

Overall, the incidence of leprosy was higher among females compared to males.
The incidence of leprosy among males was higher in 2020, with males at 6/1,000,000 population compared to 5/1,000,000 among females. The incidence was higher in both sexes in 2022 compared to other years. On average, there was no observed difference in incidence in both sexes at 8/1,000,000 population and 9/1,000,000 population for males and females, respectively (p=0.80&p=0.1) (Figure 1d).

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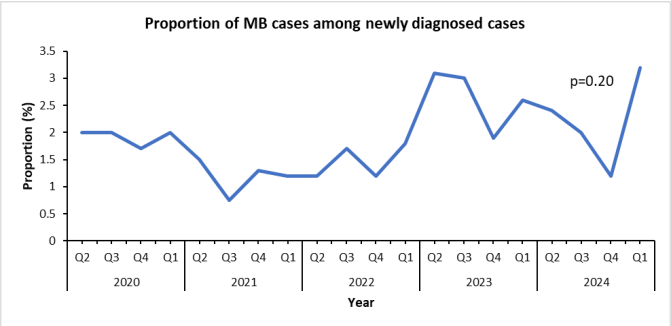

Figure 2a) Trend of proportions of MB cases among newly diagnosed leprosy cases, Uganda, 2020-2024

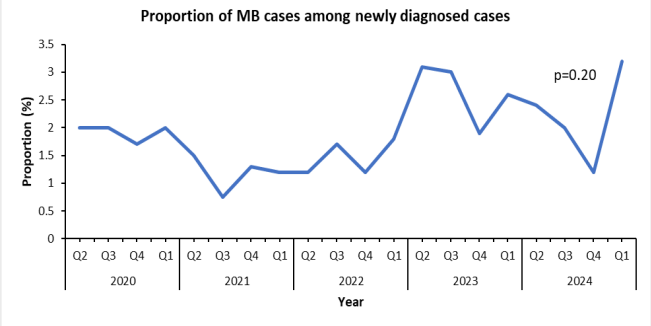

Figure 2b) Trend of proportions of G2D cases among newly diagnosed leprosy cases, Uganda, 2020-2024

Trends of the proportion of MB and G2D cases among newly diagnosed leprosy cases in Uganda, 2020-2024

Overall, there was a non-significant increase in the proportion of MB and G2D cases among the newly diagnosed leprosy cases throughout the five years (Figure 2).

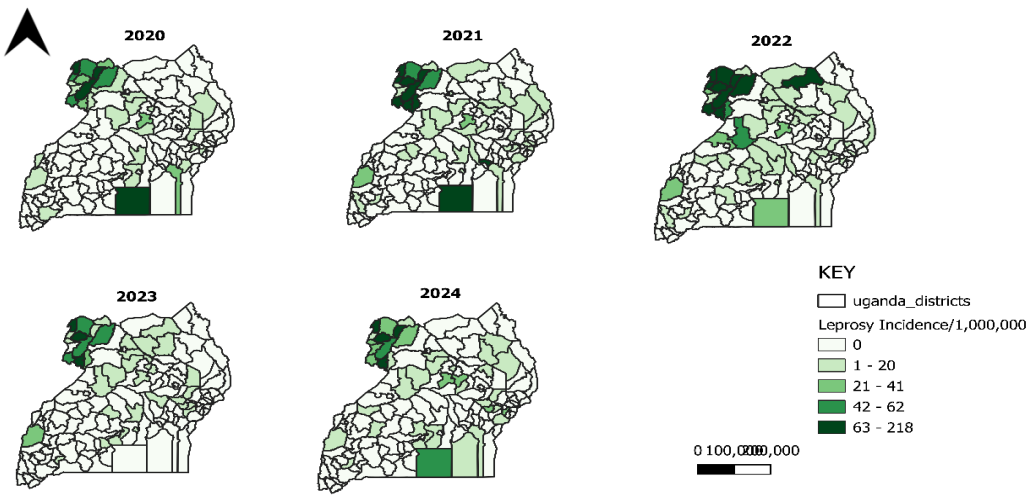

Figure 3a): Spatial distribution of Leprosy cases in Uganda from 2020-2024

Spatial distribution of leprosy cases, Uganda, 2020-2024

Approximately 72/146 (49%) of the districts in Uganda reported ≥1 new case of leprosy in the five years. There was an increase in the number of districts reporting leprosy cases, rising from 33 out of 146 districts (23%) in 2020 to 41 out of 146 districts (28%) in 2021 and further to 44 out of 146 districts (30%) in 2022. There was a drop in the number of districts reporting cases in 2023 from 44/146(30%) in 2022 to 34/146(23%) in 2023 and an increase in 2024 with 39/146(27%). The overall mean annual incidence of leprosy cases in the five years in the districts was 10 cases/1000,000 population. The mean annual Incidence of leprosy increased from 7 cases/1000,000 population in 2020 to 13 cases/1000,000 population and 15 cases/1000,000 population in 2021 and 2022. The incidence later dropped to 7/1,000,000 population in 2023 and increased to 8/1,000,000 population in 2024 with fewer districts affected (Figure 4a).

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The districts of Terego, Obongi, Madi okollo, and Koboko were the most affected districts with an overall incidence of > 100 cases/1000,000 population across the five years. 8/9(80%) of the most affected districts were predominantly from the West Nile region located in the northwestern part of the country.

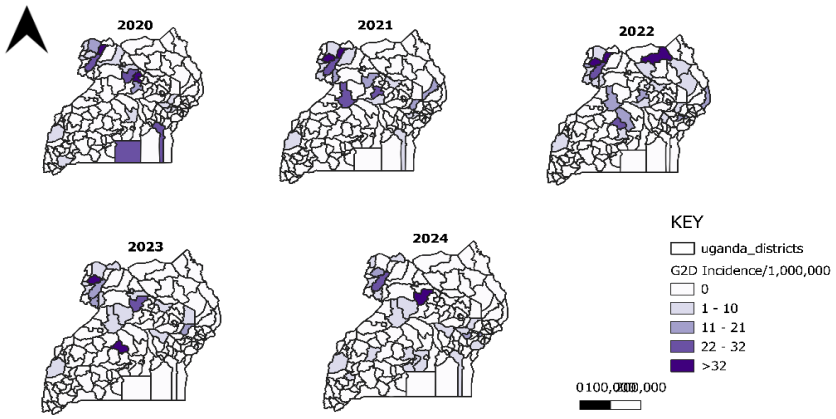

Figure 3b) Spatial distribution of newly diagnosed G2D cases in Uganda, 2020-2024.

Spatial distribution of G2D cases in Uganda from 2020 to 2023

Overall, there was a steady rise in the incidence of G2D cases reported annually with an average incidence of 1 case/1000,000 population. The proportion of districts reporting at least one case of G2D increased between 2021 and 2022 from (20/146 (14% to 27/146 (19%. The year with the least number of districts reporting was 2023 (17/146), 12%. Overall, 2021 and 2022 recorded the highest mean annual incidence of G2D cases at 3 cases/1000,000 population, while 2020 and 2023 reported the lowest incidence of 2 cases/1000,000 population. The most affected districts each year were Kole District with an incidence of 70 cases/1000,000 population in 2020, Obongi District with an incidence of 99 cases/1000,000 population in 2021, Terego District with an incidence of 69 cases/1000,000 population in 2022, Kiboga District with an incidence of 65 cases/1000,000 population and Oyam district with an incidence of 56 cases/1,000,000 population in 2024. (Figure 4b).

Discussion

The overall incidence of leprosy had increased over time with equal rates across both genders. Most of the cases reported were multibacillary type leprosy with 23% of the multi-bacillary cases classified as G2D. The districts in the West Nile Region were the most affected in the country during 2020-2024.

Thirteen percent of the leprosy cases identified across the country were children. This is double the National Strategic Plan (NSP) target of 6%, which may imply evidence of active spread of the disease among the population, as cited in the WHO leprosy report of 2022(11)

Eighty-six percent of the cases notified were multibacillary cases, which may suggest the occurrence of active transmission of the disease and, consequently, greater potential to incapacitate the affected individuals. This may also signify late case detection, which may result in late diagnosis and, eventually, disability. In addition, people who are affected by multibacillary forms of the disease have a greater chance of developing health problems, Leprosy is highly disabling when not properly treated in the population, which can influence academic school performance (and future occupation) and cause problems related to social limitations, discrimination, self-esteem, and stigma experienced by the affected person(12).

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There was a growing trend in the number of G2D cases from 2022 to 2023, which may indicate that the country faces difficulties in the early diagnosis of the disease and ongoing transmission. Our study was entirely descriptive, covering the whole population; however, the fact that there is an increasing trend of G2D cases is concerning, as it falls far short of the WHO goal of zero disability in children.(13)

In our study, the highest number of leprosy cases was reported in 2022, which coincided with the period following the launch of the Community Awareness, Screening, Testing, and Treatment (CAST) campaign in 2021 at ending TB and leprosy in Uganda. (14).

The most affected districts were the West Nile region located in the northwestern part of the country. West Nile has historically been a region with significant refugee populations due to its proximity to neighboring countries like South Sudan, the Democratic Republic of the Congo (DRC), and Sudan where there is political conflict accompanied by weak health systems. Refugees often bring diseases, including leprosy, from their home countries, leading to an increased risk of transmission. Secondly, the region has experienced prolonged conflict, particularly in the northern and western parts of Uganda.

Study limitations: Among the limitations of the study, the use of secondary data, with the presence of untimely reporting and incomplete data can't be overlooked. This could have underestimated the incidence of the disease across the country. We, however, catered for this gap by cross-referencing our findings with what the national TB and leprosy program had reported, making our findings reliable and valid.

Conclusion: Uganda is not yet on track for leprosy elimination, with ongoing cases and delayed diagnoses indicated by G2D. The high incidence in the West Nile Region highlights the need for targeted interventions. To accelerate progress toward elimination, further studies are needed to explore the underlying factors contributing to the persistent incidence, especially in the most affected districts. We recommend further studies to evaluate the surveillance system for Leprosy, especially in the most affected districts and regions. We also recommend further studies to understand the factors associated with the increase in leprosy cases particularly G2D and multibacillary cases reported among the most affected districts of the country.

Conflict of Interest

The authors declared no conflict of Interest

Author Contributions: GA, AG, RM, AM, BK, RK, ARA, ST wrote the protocol of the study. GA analyzed and interpreted the data. GA drafted the initial bulletin, GA, AG, RK, and RM contributed to the first draft and all authors read and approved the final bulletin. Permission to publish the article was obtained from all the bulletin authors.

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Trends and Spatial Distribution of all-cause Mortality, Uganda, 2018–2023

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Summary

Background: All-cause mortality statistics are vital for health planning and policy formulation and planning. The 2019 report from National Identification and Registration Authority shows that only 1% deaths are notified annually. We described the trends and spatial distribution of all-cause mortality data, 2018–2023, to inform Ministry of Health of the need to implement disease specific interventions in regions.
Methods: We analyzed secondary data from the District Health Information Software 2 and the 2022 Uganda Demographic and Health Survey for mortality data of 2018–2023. We abstracted mortality data at national level on all-cause mortality by age, sex, and admission. We calculated the crude death rate, described the leading all-cause mortality, calculated all-cause mortality rates per 100,000 population, and established the trends in distribution and its significance using the Mann Kendall test.
Results: Malaria was the leading cause of mortality among all age groups accounting for an average of 10% (28,000/290,325) followed by neonatal conditions 8% (23,871/290,325) registered deaths during the study period. Malaria cases increased from 358/100,000 in 2018 to 388/100,000 in 2023 (p=0.08). Kampala Region consistently registered high mortality rates across the six years: 2018 (641/100,00), 2019 (683/100,000), 2020 (723/100,000), 2021 (645/100,000), 2022 (609/100,000), and 2023 (712/100,000). Lango Region consistently registered low mortality rates from 43/100,000 in 2018 to 55/100,000 in 2023 (p=0.02).
Conclusion: Our analysis underscores the persistent challenge of malaria as a top cause of mortality in Uganda. The consistently high mortality rates in Kampala and the significant rise in Karamoja and Busoga region emphasize the need for region-specific interventions. Targeted interventions to improve neonatal care and strengthen malaria control are crucial to reducing mortality and enhancing regional health outcomes.

Background

Cause-mortality is a measure of the total number of deaths from any cause in a population over a specific period of time (1, 2). Uganda like other Sub Saharan African countries has been crippled by both communicable and non-communicable diseases that have resulted in high rates of morbidity and mortality and impacted the health system greatly. Studies have been conducted globally on cause of mortality: malaria, measles, E. coli, and tuberculosis (TB) but few studies have examined the major causes of morbidity and mortality in Uganda (3). Many of them have focused on individual diseases of interest (3). To report statistics on causes of mortality in any country, vital statistics have to be registered and notified from health facilities and the community (4). We described the trends and spatial distribution of causes of mortality surveillance data, 2018–2023, to inform Ministry of Health of the need to implement disease specific interventions in regions.

Methods

Study design, setting, and data source: We conducted a descriptive analysis of all-cause mortality surveillance data generated from all the healthy facilities in Uganda through the District Health Information System 2 (DHIS2), 2018-2023.

The World Health Organization (WHO) rolled out the implementation of the Medical Notification and Certification of Cause of Death (MCCoD) in 2021 but the overall death certification remains low at 11% at health facilities. Most of the mortality data captured in the DHIS2 is not medically certified. Regional population statistics were obtained from the 2022 UDHS report and these were used to calculate the crude death rates and regional mortality rates.

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Data is captured at different levels using different tools. At health facility level: when death occurs, the designated HCW completes the MCCoD, code named HMIS Form 100 to notify death, and to certify cause of death (CoD) and thereafter data is entered into DHIS2. At community level: community health workers (CHEWs) notify death after receiving notifications from community leaders or household member using the HMIS 097b report which is later captured into the DHIS2. The CHEWs also use the electronic Community Health Information System (eCHIS) which is linked to the DHIS2 although this system is only operating in 17 districts. Verbal autopsy is also used to determine CoD through interviews with the deceased's next of kin or caregivers when a notification is received.

Study variables and data analysis: We abstracted annual mortality surveillance data from DHIS2 on all-cause mortality, 2018–2023, for data on age, sex, admissions, number of deaths at health facilities. We calculated the crude mortality rate as the total number of deaths by mid-year population per 100,000 for the study period. We described the top five leading causes of mortality among all age groups for the study period. We calculated mortality rates for all causes of mortality as a ratio of total deaths (numerator) by total population per region (denominator) per 100,000 and described their annual trends. We used the Mann Kendall test of seasonality and significance to determine the trends and described spatial distribution mortality across the 15 regions using choropleth maps to show the most affected regions per year.

Ethical considerations: Our study utilized routinely aggregated surveillance data with no personal identifiers in health facility outpatient and in-patient monthly reports, obtained from the DHIS2. The Uganda Public Health Fellowship Program is part of the National Rapid Response Team and has been granted permission to access and analyze surveillance data in the DHIS2 and other data such as survey and field investigation data to inform decision-making in the control and prevention of outbreaks and public health programming. Additionally, the Ministry of Health granted the program permission to disseminate the information through scientific publications. We stored the abstracted dataset in a password-protected computer and only shared it with the investigation team.

Results

Trends in crude mortality rate, Uganda, 2018–2023

The crude death rate was 649/100,000 population with a total of 290,325 deaths registered during the study period. There was a non-significant increase (p=0.06) in crude mortality rate from 112/100,000 persons in 2018 to 119/100,000 in 2023 (Figure 1).

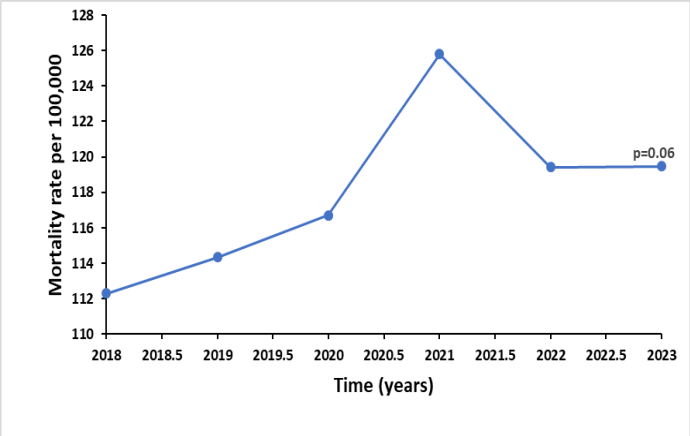

Figure 1: Trends in crude mortality rate, Uganda, 2018–2023

Description of leading all-cause mortality, Uganda, 2018–2023

Across the study period, the five leading all-cause mortality were malaria, all neonatal conditions, pneumonia, and anaemia among all age groups. Malaria averaged at 10% followed by neonatal conditions at 8.1%, and pneumonia at 6.7%. In 2018, the leading cause of mortality was malaria at 13% (4,501/34,491) and injuries at 11% (1,968/18,697). Anaemia became the 3rd leading cause of mortality accounting for 6.2% with malaria and neonatal conditions each contributing 18% of all total death among children <5 years in 2019. In 2022, death attributable to neonatal conditions reduced from 5,899 (10.4%) in 2021 to 3,730 (7.0%). However, the total number of deaths decreased from 53,909 in 2021 to 52,799 in 2022. In comparison to other years studied, there was a notable gradual decline in the proportion of leading all-cause mortality for malaria and neonatal conditions from 13.3% and 6.5% in 2018 to 7.5% and 6.8% in 2023.

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Stroke/cardiovascular conditions have continued to account for low mortality for all years at 1.4% although in 2023 there was a notable marginal increase of 0.1% between 2021 and 2022.

Trends of leading all-cause mortality, Uganda, 2018–2023

Among all age groups

In all the years studied children <5 years were the most affected by different all-cause mortalities accounting for 7.0% in deaths. Malaria was the leading cause of mortality accounting for an average of 10% (28,000/290,325) followed by neonatal conditions with an average of 8% (23,871/290,325) of all mortalities registered during the study period. There was an increase in all-cause mortality rates for malaria and neonatal conditions with no significant trend (p=0.13) during the study period (Figure 2). Malaria mortality rates increased from 13% to 8% (p=0.13) and neonatal conditions increased from 6.5% to 6.8% (1), Similarly, there was a decrease in mortality rates for pneumonia, anaemia and road traffic accidents but with no significant trend. Pneumonia mortality rates decreased from 8.2% to 6.8% (p=0.25), anaemia from 6.5% to 4.0% (p=0.13) and RTA from 7.1% to 2.9% (p=1).

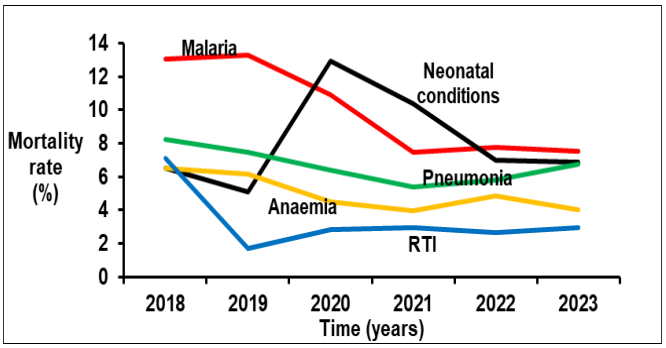

Figure 2: Trends in leading all-cause mortality among all age groups, Uganda, 2018-2023

Among children Under-5 years

Malaria was the leading cause of mortality among children <5 years over the six-year period ranging from 11%–18%, followed by neonatal conditions that declined from 16% in 2018 to 6.8%% in 2023 with no significant trend (p=0.7), pneumonia from 7.2% to 6.8%, (p=0.7), anaemia from 5.7% to 4.0% (p=0.7) and septicemia from 3.3% to 1.8%, (p=0.3) (Figure 3). Malaria cases increased from 358/100,000 in 2018 to 388/100,000 in 2023 although there was a notable non-significant decreasing trend in the same period (p=0.08) among children <5 years.

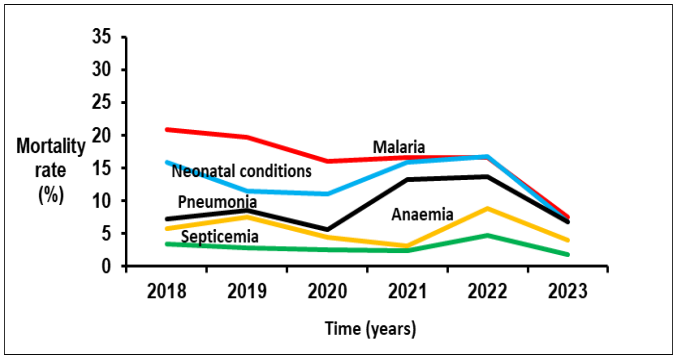

Figure 3: Trends in leading all-cause mortality among children <5 years, Uganda, 2018–2023

Spatial distribution of mortality rates by region, Uganda, 2018–2023

Kampala Region consistently registered high mortality rates across the six years with the highest mortalities (723/100,000) registered in 2020 and the lowest in 2022 (609/100,000) (Figure 4). Lango region consistently registered low mortality rates with the lowest rate (43/100,000) registered in 2018 (Figure 4). However, there was a steady increase in mortality rates in regions like Karamoja and Busoga.

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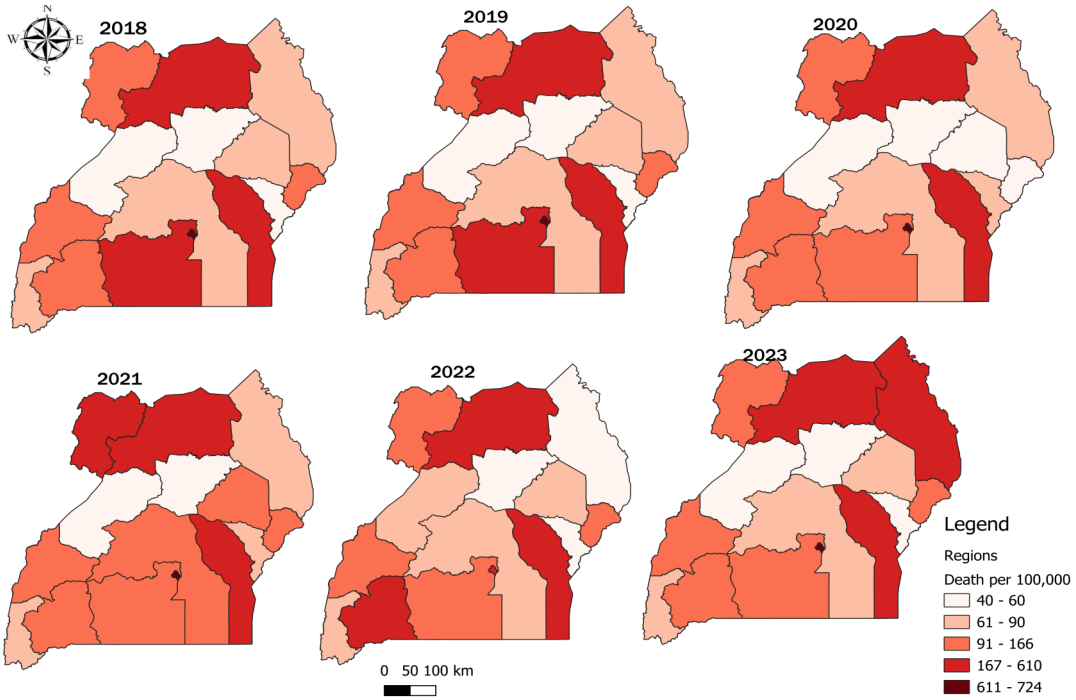

Figure 4: Spatial distribution of leading all-cause mortality, Uganda by region per 100,000, 2018-2023

Discussion

The crude mortality rate for the study period was 649/100,000 population. There was a general increase in the total number of deaths across the six-year period attributed to malaria and neonatal conditions among all age groups with more deaths registered 2023. The leading CoD: Malaria, neonatal conditions, pneumonia and road traffic accidents among all age groups. However, among children <5 years malaria and neonatal conditions were the major CoD. Stroke and cardiovascular conditions continued to account for low mortality rates. Kampala Region consistently registered high mortality rates across the six years. Lango Region consistently registered low mortality rates However, there was a steady increase in mortality rates in regions like Karamoja and Busoga.

There was an increase in the number of reported deaths over the six-year period among all age groups with more mortalities attributed to malaria and neonatal conditions. Increase in mortality both 2020 and 2021 can be attributed to the interruption of health service delivery and other associated consequences of COVID-19 outbreak (12). Some of these include, fear of movement to get infected, restrictions, long distances given lack and or inadequate means of transport to healthcare facilities. Similar to this study, a systematic review in 2021 estimated an increase in global mortality as a result of COVID-19 at 18.2 million while United States of America, there was a remarkable increase in CoD mostly among older adults, 25–44 years as a result of unintentional drug overdoses (13) (14).

There were differing proportions of death across all 15 regions, with some regions like Kampala registering high mortality rates and Lango registering low. This difference in distribution is attributed to the differing burden of disease in the regions that can be linked to differences in healthcare services and health seeking behaviors; availability and accessibility at different points of care (15).
In this study, neonatal conditions: neonatal sepsis 0-7 days, preterm baby and birth asphyxia were the leading causes of mortality among children <5 years in 2020-2023. Although these varied in different regions, there was a significant decline over the three years and this can also be attributed to a number of improvements in maternal service delivery at healthcare facilities: improved antennal attendance by expectant mothers, delayed cord clamping and kangaroo practices (20) (21) (22). Similarly, the 2021 UDHS report showed neonatal mortality decreased from 33 deaths per 1,000 live births in 2000-2001 to 22 deaths per 1,000 live births in 2022 (23).

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Study limitations: Mortality data captured in DHIS2 is incomplete, with most of it not medically certified. Registration of Persons Act (ROPA) 2015 mandates that registration of every death within Uganda is compulsory and a MCCOD must be issued. Use of data in the DHIS may result in under-estimation or over-estimation of mortality statistics for a given cause of mortality. Secondly, descriptive analysis of routinely reported surveillance data is liable to reporting biases: delays in reporting and or non-reporting, and notification of death at health facilities which causes under-estimation of vital statistics that we experienced in this analysis.

Conclusion: Overall, there was a declining trend in mortality rates across the six years although a notable rise was seen in 2021. Our analysis underscores the persistent challenge of malaria and neonatal conditions as a top cause of mortality among all ages. The consistently high mortality rates in Kampala Region emphasizes the need for disease and region-specific interventions. Targeted interventions to improve implementation of malaria control measures and neonatal care are crucial to reducing mortality and enhancing regional health outcomes across all age groups and regions. Increasing the proportion of trained HCW who can correctly diagnose, certify and notify death would go a long way to improve the quality of mortality data captured to be able to identify trends and patterns in mortality that might signal evolving health challenges among populations. Additionally, capturing death using the MCCoD upon death of a patient should be mandatory at the health facility.

Competing interests: The authors declare that they had no conflict of interest.

Author Contribution: JOK: Participated in the conception, design, analysis, and interpretation of the study and drafted the article and bulletin; EN participated in the conception of the study; EM participated in the analysis; RM, HTN, PE, and SL reviewed the report, HTN reviewed the article for intellectual content, and made multiple edits to the draft bulletin; BK and ARA reviewed the manuscript to ensure intellectual content and scientific integrity. All authors read and approved the final bulletin.

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Trends and distribution of malaria mortality among children and adolescents aged 0-17 years, Uganda, 2023: descriptive analysis of Medically Certified Cause of Death data

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Summary

Background: Malaria remains a leading cause of mortality in sub-Saharan Africa, accounting for 95% of global malaria deaths, with children under five being the most affected. Uganda ranks among the top five contributors to malaria cases and deaths, despite ongoing control efforts such as insecticide-treated nets (ITNs) and artemisinin-based combination therapies (ACTs). We analyzed trends and distribution of malaria deaths among children aged 0–17 years, Uganda, 2023, using Medically Certified Cause of Death (MCCD) data, to inform targeted interventions and improve malaria mortality surveillance.
Methods: We conducted a secondary analysis of MCCD data in the District Health Information Software version 2 (DHIS2) from January 1-December 31, 2023. We analyzed MCCD data with malaria deaths disaggregated by age group, sex, region, and health facility type. Spatial distribution by region was depicted by the use of Quantum Geographic Information Software.
Results: A total of 5,002 deaths were recorded among children and adolescents aged 0-17 years. The highest mortality rates were observed in the North Buganda (1369) and Lango (940) regions accounting for 40.7% of the total deaths. The majority of malaria deaths occurred in children aged 14-17 years (36.5%) and 0-4 years (36.1%), accounting for 64% of female deaths and 45% of male deaths.
Conclusion: We highlight disparities in malaria mortality among children and adolescents in Uganda, with marked variations by sex, age, and region.

Background

Malaria remains one of the leading causes of morbidity and mortality worldwide, particularly in low- and middle-income countries. In 2022, an estimated 619,000 malaria deaths occurred globally, with sub-Saharan Africa accounting for 95% of these deaths. [1]. Children under five years are disproportionately affected, contributing to 80% of malaria deaths in the region [1]. The persistent burden of malaria in sub-Saharan Africa is driven by high *Plasmodium falciparum* transmission, vector resistance to insecticides, and gaps in healthcare access. In East Africa, Uganda ranks among the top five contributors to global malaria cases and deaths, with high transmission rates occurring year-round[1].

Despite significant investments in malaria prevention and control, including insecticide-treated nets (ITNs) and artemisinin-based combination therapies (ACTs), Uganda continues to experience a high malaria burden, with 478 cases per 1,000 people annually[1][2]. Malaria accounts for 30–50% of outpatient visits, 15–20% of hospital admissions, and 37,195 deaths in 2023 [3]. The highest malaria prevalence is observed in northern and eastern Uganda, where healthcare infrastructure is often inadequate. Children remain the most affected due to delayed diagnosis, limited access to treatment, and severe complications[4–6]. Additionally, geographic disparities in malaria mortality persist, with higher deaths in regions with poor healthcare access and low intervention coverage[7].
Understanding the burden and distribution of malaria deaths is crucial for guiding targeted interventions and policy decisions. By identifying high-risk age groups and regions, interventions to address the lack of age- and region-specific malaria mortality data, would be crucial for enhancing the effectiveness of Uganda's malaria control and prevention programs. Additionally, it will contribute to improving death reporting systems, and demonstrate confidence in using the available data on the National Mortality Surveillance dashboard [8]. We analyzed trends and distribution of malaria deaths among children aged 0-17 years, Uganda, 2023 using Medically Certified Cause of Death (MCCD) data.

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Methods

Study setting, design, and data source: Uganda is located in the East African region and the civil registration and vital statistics (CRVS) system is still evolving. While progress has been made in birth registration, especially for children under five, death registration remains underdeveloped. As of 2023, fewer than half (49%) of reported deaths were officially notified, and only 34.1% were medically certified [9].

We conducted a retrospective descriptive study using data from MCCD dataset available in District Health Information Software version 2 (DHIS2). The MCCD dataset compiles data on deaths recorded in Uganda with a focus on those medically certified deaths. It includes vital mortality data, where the cause of death has been formally determined by a medical professional. Data is collected from various health facilities across Uganda, including hospitals and health centers, where death notifications and medical certifications are processed. The dataset includes detailed information on the demographic characteristics of the deceased, such as age, sex, residence, and medical cause of death, with specific codes assigned based on the International Classification of Diseases (ICD). The MCCD form is completed by physicians based on clinical assessment, diagnostic findings, and available medical records, ensuring standardized cause-of-death reporting. Data is collected at health facilities and community level during patient death certification and subsequently compiled into national mortality databases by filling out form 100, which in turn feeds that data into DHIS2.

Study variables, data abstraction, and data analysis: The dependent variable was malaria deaths. Independent variables included age (0-17 years), gender (male and female), geographic region (high vs. low malaria transmission areas), health facility level (district hospitals, health centers, or private clinics), and cause of death certification (the proportion of medically certified deaths). These variables were analyzed to identify patterns and disparities in malaria mortality.

Data for all these variables was abstracted from the MCCD data base and exported in Microsoft Excel™ and analysis in R software. Descriptive statistics were calculated to including deaths by age, gender, and geographic location. Proportions of malaria deaths per age group, gender and region were calculated, and geographic and temporal variations in malaria deaths were depicted using Quantum Geographic Information System (QGIS) to identify high-burden regions and trends over time.

Ethical consideration: This study utilized secondary data from the Medically Certified Cause of Death (MCCD) dataset, which does not involve direct interaction with human participants. As such, formal ethical review and approval were not sought. However, administrative permission to access the data was obtained from the Director General of Health Services and the Division of Health Information, Ministry of Health, Uganda. These permissions ensured compliance with national regulations regarding the use of public health data. The study adhered to ethical principles related to confidentiality and data security, ensuring that all data were anonymised and securely stored to protect individual privacy.

Results

Geographic distribution of malaria deaths among children aged 0-17 years, Uganda, 2023

A total of 5,700 malaria deaths were reported across all age groups. Of these deaths, 5,002 were of children and adolescents aged 0 -17 years, with regional disparities (Table 1).

The highest malaria mortality was reported in regions of North Buganda (1,369 deaths) and Lango (940 deaths), accounting for 40.7% of the total deaths. The sub-regions of Toro (564 deaths), Bunyoro (470 deaths), and South Buganda (337 deaths) reported moderate mortality rates, collectively contributing to 24.3% of the total deaths (Figure 1). The regions of Karamoja (28 deaths), Busoga (106 deaths), and Elgon (158 deaths) reported the lowest mortality rates, representing 5.3% of the total deaths

Age-specific mortality among children aged 0-17 years, Uganda, 2023

Of the 5,002 medically certified deaths, 274 (100%) were malaria deaths and the majority were reported among children aged 14-17 years (36.5%) of age (Table 1).

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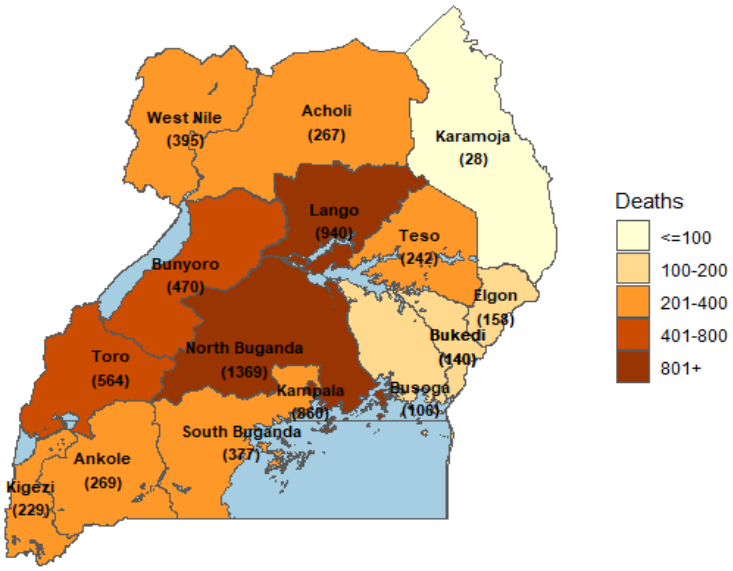

Figure 1: Distribution of malaria deaths among children and adolescents, 0-17 years, Uganda, 2023

Table 1: Distribution of malaria deaths by age group among children and adolescents,0–17 years, Uganda, 2023

Age groups (years)	Malaria deaths n (%)	Total deaths	% malaria deaths per age group
0-4	99 (36.1)	1,287	7.7
5-9	52 (19.0)	153	34.0
10-14	23 (8.4)	106	21.7
15-17	100 (36.5)	3,456	2.9
Total	**274 (100)**	**5,002**	**66.3**

Gender distribution of malaria deaths among children aged 0-17 Years, Uganda, 2023

More malaria deaths occurred among females (64%) than males (45%). In the 5–9 age group, mortality was similar between males (29%) and females (28%). The disparity widened in the 10–14 age group, where male deaths (19%) outnumbered female deaths (5%). In the 15–17 age group, male deaths (7%) were more than triple those of females (2%). Overall, while younger females had higher mortality, older males exhibited the highest death rates, particularly in the 10–14 and 15–17 age groups (Figure 2).

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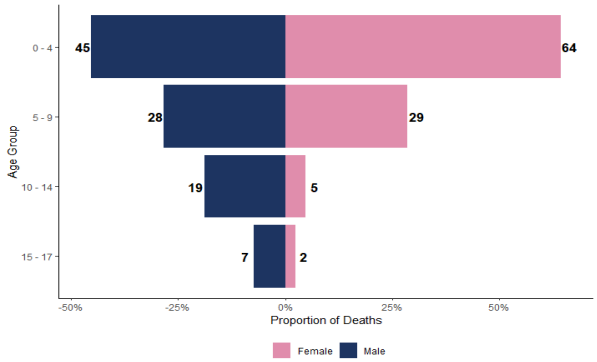

Figure 2: Gender Distribution of Malaria Deaths Among Children Aged 0-17 years in Uganda, 2023

Distribution of malaria deaths among children and adolescents, 0-17 years by health facilities, Uganda, 2023

Lira Regional Referral Hospital (RRH) reported the highest number of malaria deaths, with 58 deaths (31.52%) (Table 2). This was followed by Kagadi General Hospital (GH) with 21 deaths (11.41%), and both Hoima and Kayunga RRHs, each reporting 16 deaths (8.70%). The remaining facilities reported fewer deaths, with most facilities recording under 5 deaths (2.72%), including Buvuma HCIV, Dr. Ambrosoli Memorial Hospital Kalongo, Kangulumira HCIV, Luwero GH, Mubende RRH, and St. Mary's Hospital Lacor, each reporting 1 death (0.54%) (Table 2).

Table 2: Distribution of malaria deaths among children and adolescents, 0-17 years by health facility, Uganda, 2023

Health facility	Malaria deaths (n) (%)
Lira Regional Referral Hospital (RRH)	58 (31.52)
Kagadi General Hospital (GH)	21 (11.41)
Hoima RRH	16 (8.70)
Kayunga RRH	16 (8.70)
Kiryandongo GH	14 (7.61)
Mbale RRH	8 (4.35)
Arua RRH	6 (3.26)
Virika Hospital	6 (3.26)
Kagando Hospital	5 (2.72)
Kiboga GH	5 (2.72)
Kyegegwa GH	5 (2.72)
Soroti RRH	4 (2.17)
Entebbe RRH	3 (1.63)
Ibanda Hospital	3 (1.63)
China Uganda Friendship (Naguru) RRH	2 (1.09)
Gulu RRH	2 (1.09)
Itojo GH	2 (1.09)
Nakaseke GH	2 (1.09)
Buvuma Health Centre (HC) IV	1 (0.54)
Dr. Ambrosoli Memorial Hospital Kalongo	1 (0.54)
Kangulumira HC IV	1 (0.54)
Luwero GH	1 (0.54)
Mubende RRH	1 (0.54)
St. Mary's Hospital Lacor	1 (0.54)
Total	**184 (100)**

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Monthly trends in malaria deaths among children and adolescents, 0-17 years, Uganda, 2023
Malaria deaths exhibit a seasonal pattern, with a notable decline from January through March (Figure 3). Mortality begins to rise in April, reaching a peak in July. This was followed by a sharp decline in August. there is a secondary increase observed in September before the trend resumes a steady decline from October through January.

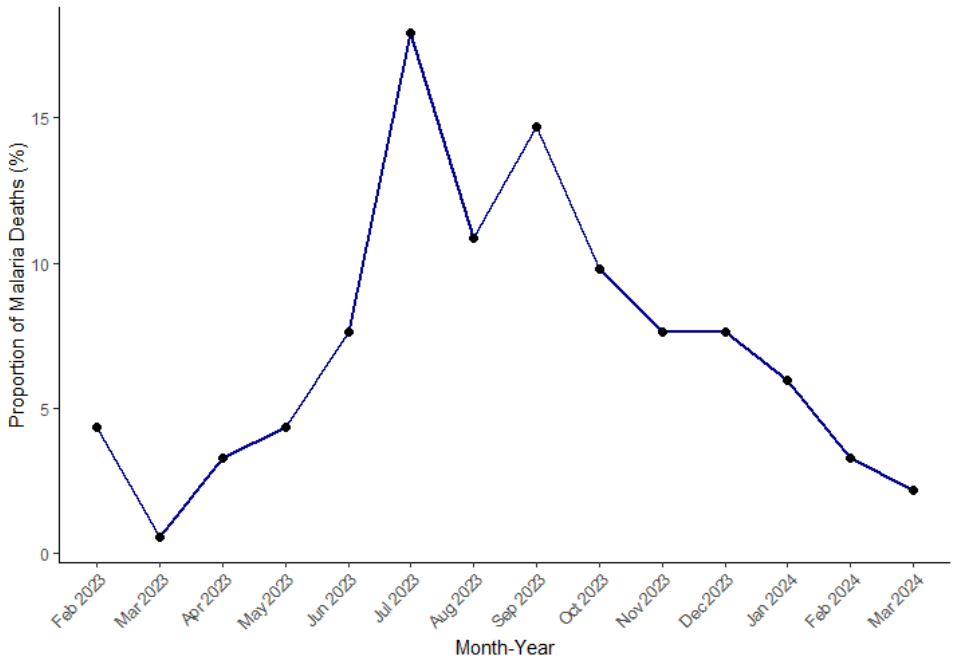

Figure 3: Seasonal patterns and distribution of malaria deaths among children and adolescents, 0-17 years, Uganda, 2023

Annual gender-disaggregated trends in malaria mortality among children (0–17 Years) in Uganda, 2023
Malaria deaths exhibit a seasonal pattern, with unequal mortality distribution across the 12 months for both sexes. However, the highest mortality for females was in July and September. For males, the highest mortality came in the months of July and September. Throughout the year, male mortality consistently surpasses female mortality (Figure 4)

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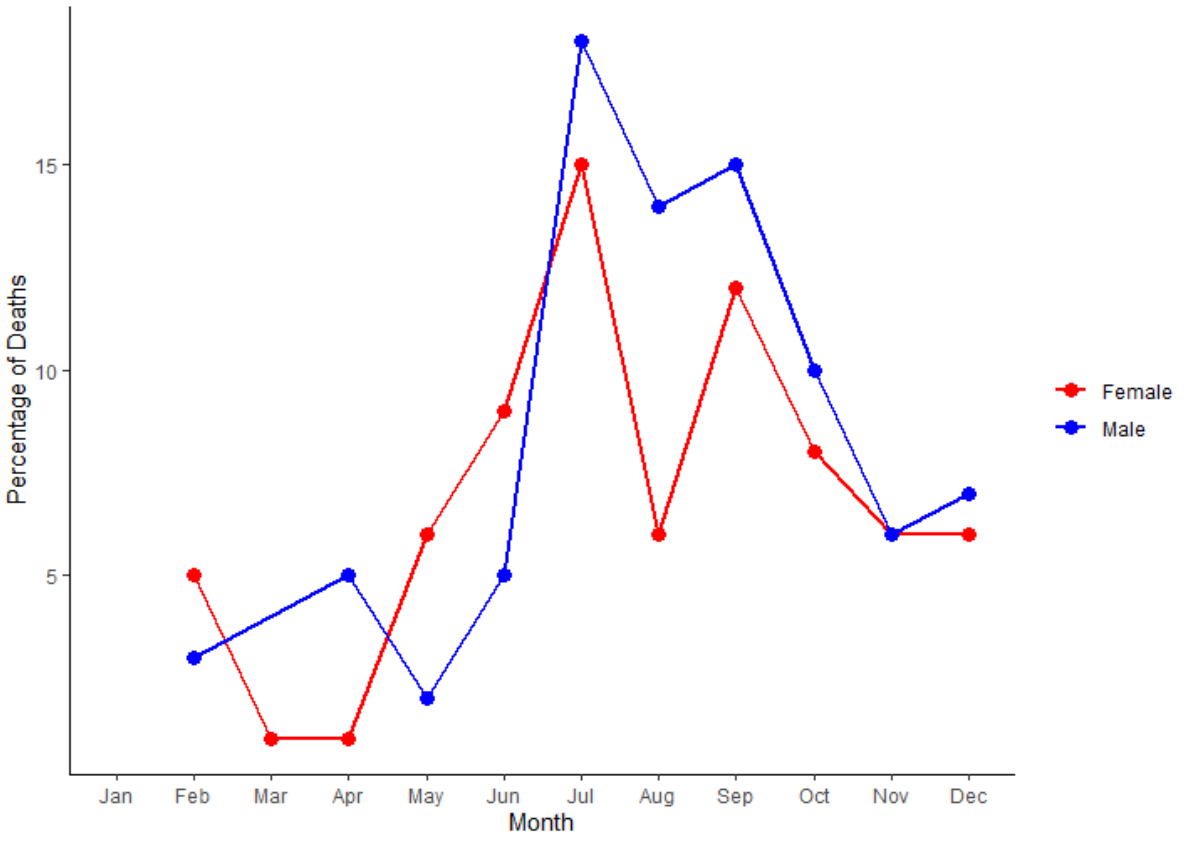

Figure 4: Monthly and gender-specific trends in malaria mortality among children and adolescents aged 0-17 years in Uganda

Discussion

In this nationwide analysis of medically certified malaria mortality among children and adolescents aged 0-17 years in Uganda, we found substantial sex, age, temporal, and regional specific disparities. Overall, malaria mortality was markedly higher in males than females, with notable seasonal peaks in July and September. Geographically, Lango sub-region and North Buganda region exhibited disproportionately high malaria mortality. Children aged 0–4 years bore the highest mortality burden across both sexes, whereas younger females had higher mortality than males, a trend that reversed in the older age groups.

In this study, we found that there was a significant geographic variation in malaria mortality across Uganda. The highest mortality rates were observed in regions such as North Buganda (1,369 deaths) and Lango (940 deaths), which together accounted for nearly 41% of all malaria deaths. In contrast, regions like Karamoja, Busoga, and Elgon reported the lowest mortality rates, contributing only 5.3% of the total deaths. The geographical disparities found in this study could be attributed to several factors, including variations in malaria transmission intensity, local healthcare infrastructure, access to prevention and treatment services, and issues of underreporting [10]. Whereas regions like North Buganda and Lango, which are in high malaria transmission areas, are more likely to experience a higher burden of malaria deaths, effective surveillance and targeted interventions are crucial to reducing mortality in these areas Conversely, the lower mortality rates in regions like Karamoja and Elgon could reflect either underreporting or lower transmission rates in these areas. Our findings are in line with previous studies in sub-Saharan Africa, including Uganda, which have consistently shown that malaria mortality is disproportionately concentrated in high-transmission areas. For instance, Wanzira et. al., (2016) observed similar regional disparities in Uganda, with northern and eastern regions bearing a higher burden of malaria mortality [11]. Our findings underline the need for targeted malaria interventions that focus on high-burden regions. Policies should prioritize increased access to malaria prevention and treatment services in the most affected regions, including more robust surveillance and mortality tracking systems.

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Additionally, in the analysis of age-specific mortality, we found that children aged 0-4 years and adolescents aged 5-9 years were particularly vulnerable to malaria deaths. We reckon that the higher proportion of malaria deaths we saw in the younger age group could be attributed to problems of delayed diagnosis and limited prevention measures taken by caregivers of these children.

Furthermore, we also found high malaria mortality among male children. This we we think could be backed by evidence of male children having a higher susceptibility to malaria due to genetic and immunological differences. Additionally, it could be explained by exhibited behavioural patterns of male children, such as increased outdoor activities among boys, which can elevate their exposure to malaria vectors, thereby increasing infection and mortality rates. However, our finding is in line with what Mseza and others found in Western Uganda, which found male gender was independently associated with higher odds of cerebral malaria [12].

In our analysis, malaria mortality among children and adolescents in Uganda peaked notably during July and September. This temporal pattern aligns with seasonal variations in malaria transmission, which are closely associated with the country's climatic conditions. Uganda experiences two primary rainy seasons: March-May and August–October. These periods of increased rainfall create favourable breeding environments for Anopheles mosquitoes, the vectors responsible for malaria transmission. Consequently, a rise in malaria cases typically follows these rainy seasons. Our observed mortality peaks in July and September correspond to these transmission patterns, with the July peak following the first rainy season and the September peak aligning with the onset of the second. This seasonal trend found in our study is consistent with previous studies in Uganda. For instance, a study conducted in Gulu District by Ouma and others reported biannual peaks in malaria infections during June–July and September–October, periods that closely match our mortality findings[13]. Similarly, another study by Kamya and colleagues also highlighted two annual peaks in malaria transmission following the rainy seasons, reinforcing the link between rainfall and increased malaria incidence[7].

Limitations and strengths: Despite using MCCD data, our study findings could have been limited by the underreporting of deaths that characterised mortality surveillance in Uganda, particularly in rural and hard-to-reach areas. However, we ensured that we downloaded the latest mortality surveillance dataset for the year 2023. Additionally, some malaria deaths may have been misclassified due to challenges in accurate diagnosis and cause-of-death certification. However, we anticipated this and used ICD 11 code cause of death for malaria. Nonetheless, our study used a descriptive analysis of malaria mortality in Uganda using the MCCD dataset in children and adolescents 0-17 years, hence providing a valuable resource for understanding mortality patterns in the context of incomplete death registration. The study also leverages existing mortality data, which allows for large-scale analysis without the logistical challenges of primary data collection.

Conclusion: There are significant geographic and age-specific disparities in malaria mortality, with high mortality in the Lango region and North Buganda region and among older children and adolescents. Designing and implementing malaria control strategies that address the specific needs of high-burden regions and vulnerable age groups, including adolescents is critical. Increase public awareness about the importance of death reporting and improve the training of healthcare workers on cause-of-death certification.

Conflict of interests: The authors declare that they have no competing interests.

Authors' contributions: The primary author contributed to this study by conceptualising the Research design and drafting the initial manuscript. All the coauthors provided expertise in critically revising the manuscript for intellectual content. The last author supervised the overall review, provided guidance throughout the manuscript drafting, and critically reviewed and revised the manuscript for important intellectual content. All authors have read and approved the final version of the manuscript.

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Trends and distribution of HIV incidence among children aged 0-14 years, Uganda, 2015–2023

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Summary

Background: Uganda aims to achieve zero HIV transmission by 2030. However, HIV infections among children still accounted for 11% of all new HIV infections in 2023. We examined trends and distribution of HIV incidence among children aged 0-14 years, Uganda, 2015-2023.
Methods: We analyzed routinely reported HIV surveillance data from the electronic District Health Information Software Version 2 (DHIS2), 2015-2023. HIV incidence was calculated as the number of children newly diagnosed HIV positive divided by the annual population of the children aged 0-14 years per 100,000 disaggregated by sex, and age group. The significance of trends was determined using Mann-Kendall test.
Results: A total of 63,599 children aged 0-14 years were newly diagnosed HIV positive between 2015 and 2023, with an average of 7,128 children annually. HIV incidence among children initially increased from 33/100,000 in 2015 to peak at 57/100,000 in 2016 then declined to 22/100,000 in 2023 (p=0.01). Females persistently had higher incidences (69/100,000 in 2016, 30/100,000 in 2020, 28/100,000 in 2023) than males (55/100,000 in 2016, 25/100,000 in 2020, 24/100,000 in 2023). Children <5 years (49/100,000 in 2015, 32/100,000 in 2020, 30/100,000 in 2023) had higher rates than other age groups. Female children, aged 10-14 years were the most affected and consistently had higher HIV incidences than female children in other age groups. Kalangala District (117/100,000 in 2015, 83/100,000 in 2019, 120/100,000 in 2022) persistently had high HIV incidence throughout the study period. Districts: Kassanda, Kyenjojo, Luwero; and cities: Fort Portal, Gulu, Lira, and Jinja initially declined in HIV incidence from 2015 to 2020, then increased from 2020 to 2023.
Conclusion: HIV incidence among children aged 0-14 years reduced significantly from 2015 to 2023. Children <5 years and females had higher HIV incidences. We recommend strengthening elimination of mother-to-child transmission program, HIV prevention among females, and more focus on HIV prevention efforts in the more affected districts and cities.

Background

In Uganda, high HIV incidence among children aged 0-14 years accounted for 11% of all new HIV infections in 2023 against the global goal of zero infections by 2030(2,5,6). High HIV incidence among children is a barrier to achieving global targets of ending HIV/AIDS by 2030 (4).
Uganda has implemented strategies to prevent new HIV infections among children, including Option B+ program and “Start Free, Stay Free, AIDS Free" campaign (6).
Despite the HIV prevention strategies, HIV incidence among children has remained high (10,11). Moreover, these strategies have primarily focused on infants and children <2 years of age (12,13). We examined trends and distribution of HIV incidence among children aged 0-14 years, Uganda, 2015-2023 to assess progress towards the global target of zero HIV transmission by 2030.

Methods

Study setting, study design, and data source: Uganda had an estimated population of 44 million as of 2023. The overall HIV prevalence is 5.1% with females (6.5%) having a higher prevalence than males (3.6%) as of 2022 (5). The country has 15 non-administrative regions divided into districts and cities. HIV prevalence across the regions varies from 2.3% to 8.5% (5). We analysed routinely collected HIV surveillance data from the District Health Information Software Version 2 (DHIS2). Among other parameters, the DHIS2 includes aggregated data on the number who newly tested HIV positive disaggregated by age, sex, region, and district. We used aggregated monthly data on the number who newly tested HIV positive for the age group 0-14 years to achieve our study objectives.

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Study variables, data abstraction, and data analysis: We abstracted and exported data to Microsoft Excel™ and STATA 16, from the health unit monthly report, also known as HMIS 105, 2015-2023. Data for each period was disaggregated into national, regional, district, sex (female and male), and age groups (<5 years, 5-9 years, 10-14 years). We calculated the HIV incidence as the number of children newly diagnosed as HIV positive divided by the annual population of children aged 0-14 years for the nation, and disaggregated by district, sex, and age group per 100,000 from 2015 to 2023. We obtained the population statistics for each stratum from the Uganda Bureau of Statistics (14). To further conceptualize findings, we abstracted data on reporting rates, calculated as the percentage of complete monthly reports divided by the number of expected reports from 2015 to 2023. We used line graphs to demonstrate trends for overall (national), sex, age group, and regional HIV incidences. We determined the significance of each trend using the Mann-Kendall (MK) significance test. Choropleth maps per region and district were generated using Quantum Geographic Information Software (QGIS) to demonstrate the spatial distribution of HIV incidence among children from 2015 to 2023.

Ethical considerations: Our study utilized routinely collected aggregated program surveillance data that did not have any personal identifiers. We obtained permission to use the HMIS data from the Ministry of Health Resource Centre which has the overall mandate to collect and store health-related information. Additionally, the U.S. Centers for Disease Control and Prevention (CDC) Center for Global Health determined our study was non-research whose primary intention was to address public health problems. We stored data in password-protected computers and data was not shared with anyone outside the investigation team.

Results

Trends of HIV incidence among children aged 0-14 years, Uganda, 2015-2023

From 2015 to 2023, there were 63,599 children aged 0-14 years newly diagnosed HIV positive with an annual average of 7,128 children during the study period (Table 1). The overall HIV incidence was 35/100,000. Females (average HIV incidence=42/100,000) and <5-year-old (average HIV incidence=45/100,000) were the most affected throughout the study period (Figure 1).

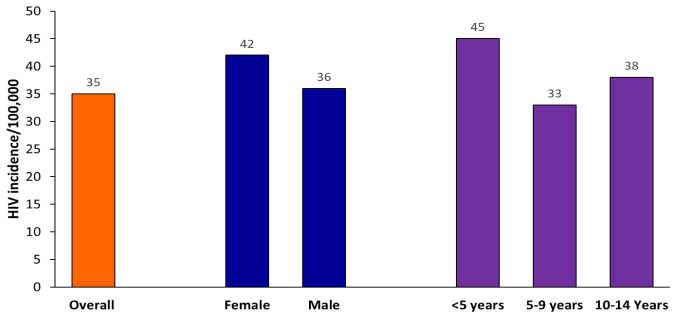

Figure 1: Overall HIV incidence among children aged 0-14 years (with further disaggregation by gender and age group), Uganda, 2015-2023

There was an initial increase in the overall HIV incidence from 33/100,000 to peak at 57/100,000 in 2016 and 56/100,000 in 2017, thereafter declined to 56/100,000 in 2023 (Figure 2A). From 2020 to 2023, HIV incidence remained constant. There was significant national overall decline in the HIV incidence among children aged 0-14 years from 2015 to 2023 (p=0.01). Outpatient reporting rates increased from 61% in 2015 to 85% in 2023. From 2015 to 2023, HIV incidence among female children aged 0-14 years was persistently higher than that of male children aged 0-14 years throughout the study period. HIV incidence among female children initially increased from 34/100,000 in 2015, peaked at 69/100,000 in 2016 then declined to 28/100,000 in 2023 (p=0.02) (Figure 2B). HIV incidence among male children initially increased from 38/100,000 in 2015 to peak at 58/100,000 in 2017 then declined to 24/100,000 in 2023 (p=0.02).

Children <5 years old had the highest HIV incidence from 2015 to 2023 in comparison to those aged 5-9 years and 10-14 years (Figure 2C). There was a general declining trend observed in all age groups: <5 years (p=0.01), 5-9 years (p=0.02), 10-14 years (p=0.03). Female children aged 10-14 years had the highest incidence than other age groups throughout the study period (Figure 2D).

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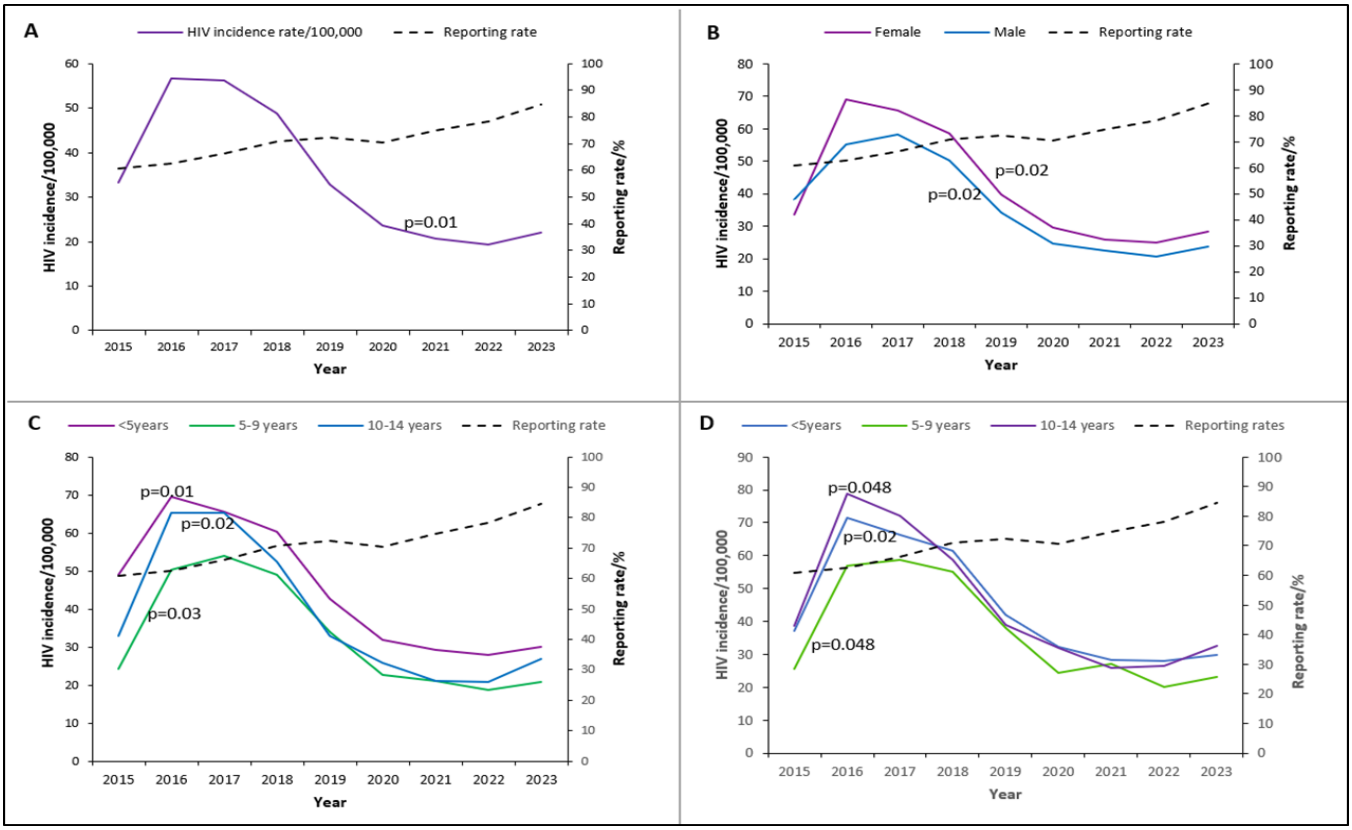

Figure 2: HIV incidence among children aged 0-14 years, Uganda, 2015-2023. Overall trends (A), and disaggregated by sex (B) and age (C). HIV incidence among female children was further disaggregated by age group (D)

Kalangala District persistently had high HIV incidence among children throughout the study period (Figure 3). Districts of Kassanda, Luwero, and Kyenjonjo; and cities of Jinja, Gulu, Lira and Fort Portal had increasing HIV incidence from 2021 to 2023.

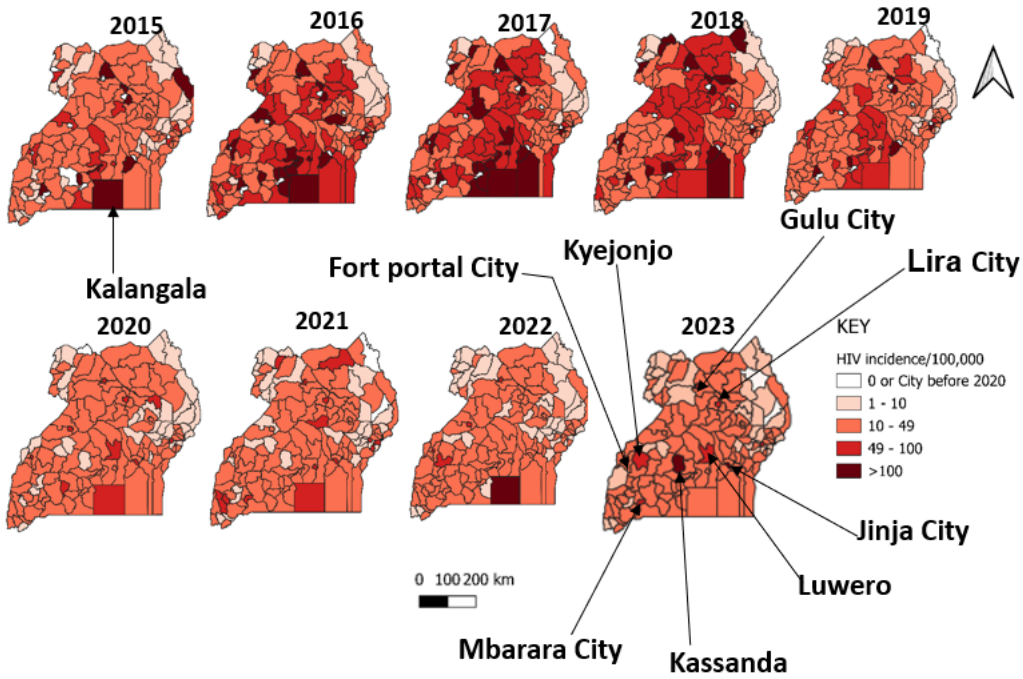

Figure 3: Spatial distribution of HIV incidence among children aged 0-14 years, by district, Uganda, 2015-2023

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Discussion

This study found that HIV incidence among children aged 0–14 years in Uganda significantly declined from 2015 to 2023, but the rate of decline stagnated from 2020 to 2023. The highest HIV incidence was observed among female children, particularly those aged 10–14 years, and children under five years old. While overall incidence declined, districts of Kalangala, Kassanda, Kyenjojo, Luwero, and cities of Jinja, Gulu, Fort Portal and Lira experienced an increase in new infections from 2020 to 2023.

Female children persistently had higher HIV incidence than male children throughout the study period. Additionally, female children, aged 10-14 years are the most affected and consistently had higher HIV incidences throughout the study period. This is in concurrence with the literature that females are more at risk of contracting HIV than their male counterparts due to social and physiological factors (20–23). Children <5 years old are more affected than the other age groups throughout the entire study period due to the mother-to-child transmission of HIV infections which continue to account for the majority of infections under this age group (1,23,24). Prevention of HIV among children should focus on ensuring universal HIV testing during antenatal care, consistent ART adherence among pregnant women, and early infant diagnosis (EID).

Targeted interventions are needed in areas with rising pediatric HIV cases, particularly urban centers like Jinja, Gulu, and Lira, and districts such as Kalangala and Kassanda, where high-risk populations and limited services contribute to transmission.

Study limitations: Descriptive analysis of routinely reported surveillance data is liable to reporting bias caused by delays in reporting or non-reporting of new HIV cases by health facilities which may result in the under or over-estimation of HIV incidence. The measure of HIV incidence in this study relied on the number of children who tested HIV positive for the first time per 100,000 population which is not a World Health Organization recommended measure of incidence in a population (24,25). Use of recency assays among other methods is recommended for estimation of HIV incidence in populations. However, Uganda adopted recency testing in 2022 for individuals who have tested HIV positive but only for those aged 15 years and more.

Yet, this analysis aimed to analyze trends and distribution of HIV incidence among children aged 0-14 years, 2015-2023, using HMIS data.

Conclusion: Uganda registered a significant decline in HIV incidence among children aged 0-14 years, 2015-2023. Stagnation in the decline of HIV incidence, 2020-2023 renders reaching the global target of zero HIV new infections by 2030 uncertain if prevention strategies are not revamped. Children <5 years old and females ages 10-14 years remain the largest contributors to high HIV incidence among children. There was increasing HIV incidence, 2020-2023 in the districts of Kassanda, Kyenjojo, Luwero, and cities of Fort Portal, Jinja, Gulu, Mbarara, and Lira. We recommend strengthening the EMTCT program to full pediatric HIV care and treatment coverage to all health facilities in the country; targeted HIV prevention among girls aged 10-14 years; and revamping HIV prevention efforts in the more affected districts and cities if we are to have zero new HIV infections among children by 2030.

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

Authors' contribution: DW conceptualized the idea, analyzed and interpreted the data, and drafted the manuscript. EM analyzed part of the data. RM, BK, LB and ARA reviewed the bulletin article for intellectual content.

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Outbreak Responses by the Uganda Public Health Fellowship Program, January–March, 2025

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Ebola outbreak response in Kampala District; Jan, 2025 to date

On January 30, 2025, the Ministry of Health (MoH), Uganda through the National Emergency Operations Centre received a notification of an EBOD outbreak in Kampala City, Uganda following results of a post-mortem sample that was collected from a 32-year-old nurse that tested positive for Sudan Ebola Virus. MoH deployed
epidemiologists from the Public Health Fellowship Program to support the district in this Sudan Ebola virus disease outbreak response. A total of 8
confirmed Ebola cases were mapped out in this outbreak which unfortunately spilled to Mbale and Jinja cities.

Above: *Dr. Hannington Katumba interviewing a contact at Saidina Abubakar Hospital in Matuga, Wakiso District*

Ebola outbreak response in Mbale and Jinja Cities; January, 2025 to date

The Uganda Ministry of Health declared the outbreak of Sudan Ebola Virus Disease (EVD) on 30/01/2025 after a deceased 32 years old male nurse in Mulago's samples tested positive for Sudan ebola virus disease. Prior to his death, the case-patient had visited Mbale city where he had exposed several persons including his family members, other relatives, a traditional healer, staff of Mt. Elgon hospital, Mbale Regional Referral Hospital (MRRH) and patients that visited these health facilities at that point.

A full-scale response was mounted in Mbale with the incident command center in Mbale city council offices. The index's wife and case who were high risk and priority contacts had traveled to and stayed with a relative in Jinja City. Later they turned symptomatic and that led to a full-scale investigation the city including contact identification, tracing and quarantine.

Emmanuel Okiror Okello (On the jackets), with two other fellows investigating the grave of C-001 that was rumored to have been exhumed in Mbale City

Ebola outbreak response in Kyegegwa District; March 6, 2025

On March 5, 2024, the Ministry of Health received an alert of a confirmed Ebola Virus Disease case in Kyegegwa District. This was the 12th confirmed EVD case since January 2025 when the first confirmed case was declared in Kampala. MoH deployed epidemiologists from the Public Health Fellowship Program to support the district in the outbreak response on March 6, 2025.

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They investigated to determine the outbreak scope, profile clinical characteristics of confirmed cases, conduct contact tracing and active case search and recommend evidence-based control measures. A total of 15 high risk contacts and 1 out of 6 suspects were evacuated. None of them turned positive for EVD, but one suspect tested positive for Crimean Congo Haemorrhagic Fever who was later evacuated to Fort portal Regional Referral hospital. A total of 15,403 medical records were reviewed, 105 signals were raised, 39 signals were discarded. Case verification still ongoing by the regional response team.

The team concluded that Kyegegwa district is still a high-risk district for other potential EVD cases since it harboured one confirmed case C-012. Therefore, there is need for heightened EVD surveillance and vigilance by the medical teams and community leaders, to look out for any VHF suspicious individuals in the community.

Namusisi Ann Mary and Akello Ann Loy (Fellows, on jackets) interviewing a high risk contact of confirmed case C-012 in Kyegegwa District

Crimean-Congo hemorrhagic fever (CCHF) outbreak response in Kyegegwa District; March 6, 2025

One case of CCHF was confirmed from Kyegegwa district, Western Uganda from samples collected to among suspects of Ebola virus disease. He had history of rearing and slaughtering cows at home. He presented with severe nose bleeding, vomiting blood and passing out bloody stool. A team of epidemiologists from the UPHFP were deployed to investigate this outbreak. A total of 25 contacts were listed for close monitoring and follow up.

The confirmed case was evacuated and isolated at Fortportal Regional Referral Hospital. Blood samples from 25 contacts and ticks were taken off to test for presence of Crimean Congo virus and for further management of the outbreak.

Annet Mary Namusisi and Anne Loy (on FETP jacket), DSFP Kyegegwa, Epidemiologist-Baylor, and the clinicians having a debrief after fieldwork at Bujubuli HCIV

Mpox outbreak response in Mbarara, Buvuma and Buikwe

Uganda confirmed the first two cases of Mpox on 24 July 2024 in Kasese district and the Ministry of Health formally declared an outbreak on 2 August 2024. Since then, the disease has spread inland to several other districts. The National Task Force and the Incident Management Team have been activated, while the National Mpox Preparedness and Response Plan was developed and disseminated. Although response activities have been initiated in the affected districts and countrywide, the interventions have largely remained sub-optimal, and challenges abound. Some of the key gaps include irregular coordination meetings and sub-pillar functions, limited resources and logistics for field deployment and operations, inconsistent flow of information from districts to national level due to weak response structures at operational level.

Several of the confirmed cases have not been comprehensively investigated and contacts listed. As a result, the source of infection, transmission dynamics and risk and exposure factors for many confirmed cases are not well understood.

To that effect, the Ministry of Health, with support from WHO, i deployed the National Rapid Response Teams (NRRT) to the affected districts to ramp up ongoing response measures and control the current Mpox outbreak in the country.

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Upcoming events and important world health days for public health

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World Immunization Day

Official Date: April 24 – 30, 2025.
Overview: The last week of April is celebrated as World Immunization Week. To promote the use of vaccines for protection of society from preventable diseases.

World Hypertension Day

Official Date: May 17, 2025.
Overview: May 17th is the World Hypertension Day. High blood pressure occurs when pressure in the blood vessels is high (140/90 mm Hg or more). It is a common condition that can be dangerous if left untreated. Often those affected do not feel any symptoms, so it is called the silent killer. Blood pressure testing is the only way to know about the condition. The day promotes increased awareness of high blood pressure, accuracy in measuring it, and control of non-communicable diseases associated with high blood pressure.

World Preeclampsia Day

Official Date: May 22, 2025.
Overview: May 22nd is the World Preeclampsia Day, which is a high blood pressure disorder that occurs during pregnancy and the postpartum period and is one of the global causes of maternal and newborn death.

World Asthma Day

Official Date: June 5, 2025.
Overview: World Asthma Day aims to raise awareness of asthma and highlight the importance of preventing and managing its symptoms. Asthma is a chronic respiratory disease that results in inflammation and narrowing of the airways, causing difficulty breathing. Common symptoms include coughing, wheezing, shortness of breath, and chest tightness. The severity of these symptoms can vary from person to person and change over time. This day focuses on raising awareness of the best treatment and prevention methods, to support patients and improve their quality of life.

World Sickle Cell Anemia Day

Official Date: June 19, 2025.
Overview: World Sickle Cell Anemia Day is commemorated every year on 19 June. Sickle cell anemia is defined as a group of inherited red blood cell disorders. Healthy red blood cells are round and move through small blood vessels to transport oxygen throughout the body; But in the person with sickle cell anemia, red blood cells become hard and sticky, and look C-shaped. Sickle cells die early; Which leads to a constant shortage of red blood cells.

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