# Uganda Public Health Fellowship Program

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# Abstract Book

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# Plenary Session: Surveillance and Outbreak investigations

**Food poisoning outbreak caused by Aeromonas bacteria at a funeral in Buyengo Town Council, Jinja District, Uganda, February 2024**

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**Background:** *Aeromonas* bacteria are emerging human enteropathogens that cause food poisoning, with an incubation period of 12 hours-7 days, typically 24-48 hours.
On February 15, 2024, Ministry of Health was notified of a suspected food poisoning incident in Buyengo Town Council, Jinja District, where 72 people developed gastrointestinal symptoms after a funeral. We investigated to identify the cause, magnitude and risk factors for the outbreak, to inform control and prevention measures.

**Methods:** We defined a suspected case as onset of abdominal pain and ≥1 of the following symptoms: diarrhea, vomiting or nausea in any person who attended AM's funeral in Buyengo TC in Jinja District during Feb 11–22, 2024. We identified cases through health facility records and community searches. We collected data using interviewer-administered questionnaires. We conducted descriptive epidemiology and environmental assessments to generate hypotheses. We conducted an unmatched case-control study among funeral attendees, and microbiology and toxicology laboratory tests on 20 case-patients and 14 environmental samples.

**Results:** We identified 61 case-patients; 5% died. Common symptoms included abdominal pain (100%), diarrhea (94%), vomiting (51%) and fever (34%). All (100%) case-patients ate at least one meal at the funeral. The epidemic curve revealed multiple peaks corresponding to the different serving times at supper and breakfast. Most cases presented within 12-86 hours from Monday supper time; median incubation period was 34 hours (interquartile range=26-48 hours). For both meals, beef soup served was topped-up with unboiled water and inadequately re-cooked. Sixty-two percent of the cases compared to 38% of the controls ate beef stew at supper (OR=2.7; 95%CI=1.2-6.2). Additionally, 97% of the cases compared to 40% of the controls ate leftover beef stew for Tuesday breakfast (OR=57; 95%CI=5.4-600). The main source of water used at the funeral was 'Kabakubya' stream. *Aeromonas hydrophilia* and *Aeromonas caviae* were isolated in the gastric aspirate from one of the case-patients, and water from the stream.

**Conclusion:** This was a point source food poisoning outbreak caused by consuming beef stew contaminated with *Aeromonas* at a funeral. The *Aeromonas* was traced to the nearby stream. Stopping use of water from the stream and enhanced water, sanitation and hygiene interventions helped control the outbreak.

**Key words:** Food Poisoning, Outbreak, *Aeromonas,* Uganda

# Characteristics, treatment outcomes and factors associated with death among patients with visceral leishmaniasis, Uganda, 2019–2024

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**Background:** Visceral leishmaniasis (VL) is endemic in Uganda afflicting mainly the Karamoja Region, bordering Kenya. The World Health Organization (WHO) targets to eliminate VL as a public health problem by reducing case fatality to <1%. However, the current burden of VL is largely undocumented rendering the target undeterminable. We describe VL patients in Uganda over the last 6 years, their treatment outcomes and associated factors to inform targeted interventions towards meeting WHO's target.

**Methods:** We abstracted data of VL patients from January 2019–May 2024, from the main treatment center located in Amudat District, Karamoja, including: socio-demographics, clinical characteristics including co-morbidities, treatment and treatment outcomes. We determined factors associated with VL death.

**Results:** Of 972 patients, 670 (69%) were male, 742 (76%) were ≤18 years and 373 (38%) were from Kenya. Most Ugandans were from Moroto District (434/599; 72%). The highest number of cases was in 2022 when 80% were Ugandan, while in previous years (2019–2021), more were Kenyan. Commonest symptoms were fever (98%), night sweats (77%) and abdominal swelling (72%), and average duration of illness was 2.6 months (SD=0.3 months). Severe anemia was common (512/972; 53%) and among the patients tested for co-infections, 175/969 (18%) were co-infected with malaria and 185/593 (31%) with HIV. For most patients (898/972; 92%), this was their index VL episode. Almost all (957/972; 98%) patients were cured and most (743/972; 76%) were treated with the first-line regimen. The case fatality ranged from 2% (2020–2021) to 0% (2023–2024). Being HIV positive was associated with VL death (aOR 10, 95%CI 2.2-50).

**Conclusion:** This study reveals progress towards elimination of VL as a public health problem in Uganda while highlighting the importance of cross-border transmission from Kenya. Screening and treatment of co-infections, especially HIV is necessary to mitigate death among VL patients.

**Keywords:** Visceral Leishmaniasis, Uganda, characteristics, treatment outcomes, case fatality

# Assessment of emergency medical services in Uganda, 2020–2023

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**Background:** Emergency Medical Services (EMS) is a spectrum of urgent medical care that spans from initial prehospital critical interventions, transportation, to continued care in emergency care units. In 2021, the Uganda Ministry of Health (MoH) formulated an EMS policy and strategic plan to improve the quality and accessibility of EMS. We assess trends in EMS indicators in Uganda from 2020–2023 using data extracted from District Health Information System 2 (DHIS2).

**Methods:** We extracted national and regional annual and semi-annual data on EMS indicators from DHIS2. Indicators included number of emergency patients, ambulance use, assessments of consciousness, response time, post-treatment complications and deaths at emergency units. We calculated incidence rates using mid and end-year population estimates and tested the significance of trends using Mann-Kendall test.

**Results:** The average number of emergencies was 254,258 patients, with an incidence rate of 29/10,000 between 2020–2023. Of these, 150,012(59%) received care at the scene, 22,883(9%) used ambulance services, 109,331(43%) were assessed for consciousness, and 203,406(80%) received care within one hour. A total of 4,831(1.9%) of the emergency patients developed complications within 24 hours while 45,766(18%) died. Of the deaths at emergency unit, on average, of 12,950 (41%) were attributed to medical emergencies, 7,211(23%) to road traffic injuries, 3,249 (10%) to pediatric emergencies, 3,113 (10%) to surgical emergencies, 9,104 (7%) to burns, 1,912 (6%) to obstetric/gynecological emergencies and 1,230 (4%) to poisoning. The incidence of emergencies increased from 18/10,000 in January-June 2020 to 38/10,000 in June-December 2023 (p=0.004). There was improvement in assessment of consciousness (29-50%, p=0.04) and reduction in mortality (27-7.9%, p=0.004) between 2020–2023.

**Conclusion:** We found a rising incidence of emergencies which underscores Uganda's growing demand for reliable and functioning emergency medical services system across the country. Despite a decline in mortality rate which could indicate improved emergency care, challenges remain in pre-hospital care and ambulance use.

**Keywords:** Emergency Medical Services, Complications, Medical emergencies

# Application of genomic sequencing in the cholera outbreak response in Kayunga and Namayingo districts, Uganda 2023

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**Background:** Whole Genome Sequencing (WGS) is a molecular tool that allows for comprehensive analysis of the entire genome of the pathogen. Integration of WGS in outbreak investigation allows for rapid and accurate identification of the pathogen, its virulence factors, transmission, and probable source. It also provides data on possible drug resistance. which can inform chemotherapeutic interventions. Although WGS is recommended for cholera surveillance, it has not been commonly used for this purpose in Uganda. We describe our use of WGS to identify, characterize, and determine drug resistance profiles of *Vibrio cholerae* isolated from the recent cholera outbreaks in Kayunga and Namayingo districts.

**Methods:** We collected 25 grab water samples and 144 stool samples from suspected cases during the cholera outbreaks in Kayunga and Namayingo districts, in July 2023, which were tested at the National Microbiology Reference Laboratory (NMRL). Stool samples were enriched in alkaline peptone water, and cultured on MacConkey and TCBS agars following standard guidelines. Water samples were membrane filtered and cultured the same way. Suspected Vibrio cholerae colonies were confirmed using Gram stain and standard biochemical tests. Confirmed isolates were then serotyped and tested for antimicrobial susceptibility (AST) using the Kirby Bauer disk diffusion, following Clinical and Laboratory Standards Institute guidelines. Selected isolates of *Vibrio cholerae* were then subjected to WGS using Illumina for library preparation and Miseq for sequencing.

**Results:** All 25 water samples tested negative for *V. cholerae*. Of the 144 stool samples, 55 from Kayunga and 4 from Namayingo were positive for *V. cholerae* by culture and sensitivity with resistance to erythromycin and azithromycin. Among these, 33/55 from Kayunga and all 4 from Namayingo were sequenced, all were identified as *Vibrio cholerae* serotype 01 Ogawa of ST69 Multiple Locus Sequence Type. All sequenced isolates carried the IncC plasmid harboring resistance genes to streptomycin (aadA2), ampicillin (blaPER-7), ceftriaxone (catB9), chloramphenicol (dfrA1), trimethoprim (mph (A)), erythromycin (mph(E)), azithromycin (msr (E)) sulfisoxazole (sul1) and multiple virulence factors. The similarities between the isolates from Kayunga and Namayingo suggest that the outbreaks were linked, possibly with a common origin.

**Conclusion:** The application of WGS provided a detailed characterization of *V. cholerae* and its resistance profile linking both outbreaks. This enabled characterization of the circulating vibrio cholerae strains and identified the potential sources of the outbreak which guided public health interventions and public sensitization campaigns.

**Key words:** Genomic sequencing, Cholera outbreak

# Trends of anemia in pregnancy and uptake of prevention measures during antenatal care in Northern Uganda, 2020–2023

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**Background:** Anemia in pregnancy is associated with adverse outcomes including maternal mortality and preterm births. Despite free antenatal care (ANC) services in Uganda including iron/folic acid supplementation, 30-40% of pregnant women in Uganda remain anemic particularly in the northern region. We analyzed anemia prevalence, trends, and the uptake of anemia prevention services among pregnant women, 2020–2023 in Northern Uganda consisting of Karamoja, Acholi, etc regions.

**Methods:** We analyzed quarterly data for first and fourth ANC visits routinely captured in the District Health Information Health System (DHIS2) in Uganda between 2020–2023. We abstracted regional level data on anemia stratified by ANC attendance, uptake of iron/folate (IFA), intermittent preventive therapy (IPT), and long-lasting insecticidal nets (LLINs). The prevalence of anemia was calculated using hemoglobin levels <10 g/dL and were stratified by ANC attendance. The trends in uptake of IFA, IPT, and LLINs were assessed using the Mann-Kendall test. P-values <0.05 were considered statistically significant.

**Results:** The overall prevalence of anemia among pregnant women from 2020-2024 idecreased from 10% to 9% (p-value=0.45), and 22% to 9% (p-value=0.02) at first and fourth ANC visit, respectively. During ANC 1 Uptake of IFA increased from 65% to 71% (p-value 0.914), IPT1 declined from 100% to 77 (p-value 0.000) and LLINs increased from 59% to 66% (p-value 0.013). While during fourth ANC IFA4 decreased from 80% to 65% (p-value 0.107) and IPT3 increased from 51% to 64% (p-value 0.299)

Karamoja and Acholi regions exhibited higher anemia prevalence compared to the other sub regions throughout the study. In Karamoja, the first ANC visit prevalence declined from 20 to12% (p-value=0.01. while during the fourth ANC visit declined from 15% to 13% (p=0.54). In Acholi the prevalence was steady at 17% (p=0.59) while during the fourth ANC visit declined from 30% to 10% (p=0.86). From 2020-2024 during the first ANC in Karamoja IFA uptake increased from 79% to81%(p=value 0.00), while IPT1 uptake dropped from 87% to71% (p-value=0.00). In Acholi, IFA uptake dropped from 73% to 76% (p-value=0.54), while IPT1 uptake declined from 84% to 74%(p-value=0.00). During the fourth ANC in Karamoja IFA decreased from 79% to72% (p-value=0.00), while IPT3 uptake increased from 62% to 63% (p-value=0.003). In Acholi, IFA uptake dropped from 84% to 54% (p-value=0.00), while IPT3 uptake declined from 72% 52% (p-value=0.001) from 2020-2024. The LLIN uptake increased in Karamoja, from 52% to 88% (p-value=0.00) and in Acholi from 58% to 42% (p-value=) between 2020-2024.

**Conclusion:** There was a significant decline in the prevalence of anemia during 1st ANC visit trend between 2020 to 2024. The decrease in IPT1 and increase of LLIN coverage during first ANC was also significant. Karamoja and Acholi had the highest anemia rates compared to the other sub region in Uganda. Strengthening prevention measures, especially IPT1 uptake, is crucial in addressing anemia particularly in high-burden regions during first ANC.

**Keywords:** Anemia, Pregnancy, Antenatal care, Prevention, Iron/Folate, LLINS, IPT

**Lessons from an imported Cholera Outbreak, Elegu border point, Uganda, January 2024, a 7-1-7 assessment**

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**Background:**

Cholera remains a major public health threat in Uganda, particularly in border districts that face recurrent outbreaks due to cross-border population movement. We investigated an imported cholera outbreak in Elegu Town a border point between Uganda and South Sudan in January 2024 highlighting the country's preparedness and challenges in managing cross-border disease outbreaks.

**Methods:**

A suspected case was onset of acute watery diarrhea in an asylum seeker at Elegu border point from January to February 2024 whereas confirmed case was a suspected case in which *Vibrio cholerae* has been isolated in the stool by culture or PCR. We actively searched for cases at the refugee collection center and nearby health units, collected data on person characteristics, symptoms, and timeline of the outbreak. Qualitative interviews were conducted with district health officials to understand the enabling factors and bottlenecks in the response. The 7-1-7 metric was used to assess the timeliness of detection, notification, and response to the outbreak.

**Results:**

Thirteen members of the same family traveling as refugees from South Sudan to Uganda were diagnosed with cholera within 6 hours of arrival at the Elegu border point. Of these 4(31%) were confirmed, 9(69%) were female and 7(54%) were below eighteen years. The authorities detected, notified, and responded to the outbreak within the stipulated 7-1-7 timelines. We found that the prompt response to this emergency was attributed to the recent experience with Ebola and COVID-19 outbreaks, the availability of a functional emergency operations center, and the presence of trained frontline health workers in the region.

**Conclusion:**

The imported cholera outbreak at Elegu demonstrates Uganda's preparedness in managing cross-border disease outbreaks. The achievement of the 7-1-7 targets underscores the country's capacity to detect, notify, and respond to emergencies.

Continued investment in local-level disease detection, communication between health workers and surveillance, and national-level resource mobilization remains crucial to sustaining an effective and comprehensive outbreak management strategy, especially for larger events.

**Keywords:** Cholera, imported outbreak, Cross-border outbreak management, 7-1-7 metric, Detection, Notification, Response

# Enhancing laboratory capacity for sample collection and referral during the anthrax outbreak response in Amudat district, Uganda in June 2024

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**Background:** Amudat district registered a first suspected anthrax case on December 28, 2023 from Kakworobu village and a surge of cases between January and February 2024. Anthrax outbreak was confirmed on March 15, 2024 and Ministry of Health dispatched a multidisciplinary national rapid response team on June 12, 2024, to support the response. The laboratory team set out to support the coordination of sample collection, transportation and referral to improve turnaround time (TAT).

**Methods**: We conducted a laboratory capacity assessment for two laboratories using the WHO laboratory assessment tool to assess key aspects in laboratory performance such as human resource, sample collection, handling, transportation, bio risk management, partner and stakeholder support, presence of a response plan and sample referral register. Human sample testing was supported by Uganda Virus Research Institute in Arua. Animal and soil samples were tested by National Animal Disease Diagnostics and Epidemiology Centre whereas sample transportation and referral were supported by National Health and Laboratory Diagnostics Service. We tracked the turnaround time for the referred samples to determine the average time for sample collection to results release. We supported the district team in the development a laboratory response plan and a sample referral register.

**Results**: Laboratory capacity to respond to anthrax outbreaks was at an average of 51%. The average indicator scores for Amudat Hospital and Karita HCIV laboratories was 54% and 47%, respectively. Biorisk management had the lowest score (0%) for both laboratories. The district had 100% of referral supplies present, but lacked a laboratory response plan, sample referral register, and had only 13% (2/15) competent staff. Twenty-four samples (16 human, 6 animals, and 2 soil) were collected and referred for testing. Real time PCR revealed 9/16 (56%) human samples were positive while all soil and animal samples tested negative. The average turnaround time from sample collection to result release was 10 days which compared to the target turnaround time of 3 days was too long.

**Conclusion**: Amudat district's capacity to respond to anthrax outbreaks stood at 50% which was below the recommended WHO target of 80%. The district also had long turnaround time which affects public intervention potentially leading to a larger outbreak. The district team should be given security to support timely transportation given the insecurities in the Karamoja region. The district requires routine knowledge and skills improvement to ensure efficient response to future anthrax outbreaks.

**Key words:** Anthrax, Amudat District

# Breakout Session 1: Surveillance and outbreak investigation

**Spatial and temporal trends of Conjunctivitis in Uganda, 2020-2023**

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**Background:** An estimated 30 million people in Sub-Saharan Africa are affected by conjunctivitis annually. Long-term visual impairment can occur if conjunctivitis is not detected early. Uganda is one of the many countries that experience frequent seasonal outbreaks of conjunctivitis that go undetected by the surveillance system. We investigated the spatial and temporal trends of conjunctivitis in Uganda during 2020–2023 using cases that are routinely reported at public health facilities.

**Methods:** Data on conjunctivitis cases were abstract from the District Health Information System (DHIS2) from 2020-2023. They are recorded as either allergic, bacterial or other forms at various health facilities who summarize the records and submit to DHIS2. Monthly data were abstracted and incidence rates were calculated by sex, age, district and year from 2020 to 2023. Data was imported into R software for analysis to determine the significance of trends using Man Kendall test for trends. P-values<0.05 were considered statistically significant.

**Results:** A total of 4,550,193 cases of conjunctivitis were reported over the 4-year period, with an overall incidence of 26/1000 population. Children aged 0-4years were most affected with an incidence rate of 74/1000 population (p-value=0.3). Males were more affected than females with an incidence rate of 27/1000 population (p-value=0.7). Annual seasonal spikes between March and September were observed throughout the 4-year period. Allergic conjunctivitis was the most frequently reported type constituting 48% (2,184,093) of the cases. Annual incidence slightly increased from 26/1000 population in 2020 to 27/1000 population in 2022(p=0.67). Obongi district in the northern region reported the highest incidence of 47/1000 population while Kagadi district in the west had the lowest incidence of 1/1000 population.

**Conclusion:** Children aged 0-4 years and females were the most affected groups. The country experienced annual seasonal spikes in the months of March and September each year. Obongi District in West Nile region of the country was most affected. We recommend further studies to understand the high incidence of cases in some districts and seasonal spikes in the months of March and September.

**Key words**: Conjunctivitis, incidence, temporal

# Conjunctivitis outbreak propagated by sharing eye medication in Luzira Prisons, Kampala, Uganda, February–April 2024

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**Background:** On March 7, 2024 the Ministry of Health (MoH) was notified of a rising number of inmates with suspected conjunctivitis in Luzira prisons in Kampala. A total of 314 cases had been reported with redness of eyes. We investigated to determine the cause and extent of the outbreak, identify risk factors and recommend evidence-based control measures.

**Methods:** We investigated the outbreak in 4 prisons of Luzira: Kampala Remand Prison (KRP), Murchison Bay Prison (MBP), Luzira Upper Prison (LUP) and Luzira Women Prison (LWP). We defined a suspected case as onset of redness in one or both eyes with ≥1 of the following: tearing, discharge, grainy sensation, itching, pain, or swelling, in a resident Luzira Prison from February 1 to April 3, 2024. We identified cases from health facility records and active case search among inmates. We administered a structured questionnaire to suspected cases and collected conjunctival swabs from those with eye discharges for Polymerase Chain Reaction (PCR) testing. We assessed the movement of inmates, handwashing facilities, isolation places, and administration of eye medication. We compared exposures of 200 randomly-selected cases to controls in a 1:1 ratio for the case control study. Using logistic regression, we conducted multivariable analysis and presented odd ratios with their 95% confidence interval.

**Results:** A total of 1,935 conjunctivitis cases were recorded with an overall attack rate of 23% (1,935/8,518). The attack rates varied per prison: MBP (41%, 1,229/3,000), KRP (33%, 610/1,835), LUP (12%, 83/670), and LWP (0.4%, 13/3,013). Only one staff member was affected, and there were no deaths. Enterovirus Type C was identified as the causative agent. We found that an inmate with suspected conjunctivitis was remanded at KRP on February 25, 2024. Infected inmates were continuously admitted into KRP and prisoner mixing during a plea bargain meeting in KRP triggered the spread of the outbreak to MBP. Cases were being managed through hand application of Tetracycline Eye Ointment (TEO) and short isolation periods (3 days). Sharing of eye medication between inmates increased the infection risk (aOR: 5.3, 95%CI: 2.8-9.9) while frequent handwashing reduced the odds of infection (aOR: 0.11, CI: 0.03-0.37).

**Conclusions:** Enterovirus Type C was the cause of the conjunctivitis outbreak in the prisons. It was introduced by an infected new inmate. Prisoner mixing and sharing TEO tubes likely propagated the outbreak among the inmates in various prisons. Screening and reporting, prompt and adequate isolation (≥5days), and improved hand hygiene could mitigate future risks.

**Keywords**: Conjunctivitis, Outbreak, Prison, Uganda

# Investigation of conjunctivitis an outbreak at School X in Kampala City, March 2024

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**Background:** On March 11, 2024, Kampala Capital City Authority received an alert of increase in the number conjunctivitis cases at an infant School X in Kampala City. We investigated the outbreak to determine the scope, identify factors associated with its spread, and recommend control and prevention measures.

**Methods**: We defined a case as redness of one or both eyes and any of the following: tearing, swelling, itching, discharge in a pupil or staff of school X from March 5-31, 2024. We identified cases by reviewing health records at the school. We calculated attack rates (AR) by ages, sex, class, and dormitory using staff and pupils of the infant school as source population. We also conducted staff interviews and an environmental assessment. We conducted a case-control study. We defined a control as a pupil or staff of school X who had not had conjunctivitis from March 05 to March 31, 2024. We identified factors associated with the spread of conjunctivitis in the school using logistic regression.

**Results:** We found 175 cases, 167 of whom were pupils and 8 were staff. The mean age for case-patients was 11.4 years (range 5–45 years). Attack rates (%) were similar in females and males (10 vs 8.4). Pupils in the boarding section were more affected than day scholars (AR:23) with residents of Alpha dormitory more affected than other dormitories (AR:50). Pupils in P4-P7 were the most affected compared to lower class groups (AR:17). Contact with a conjunctivitis case-patient significantly increased odds of conjunctivitis (aOR=2.8, 95%CI:1.2-6.3). Pupils in P6-P7 were 8.5 times more likely to get conjunctivitis (aOR=8.5, 95%CI: 2.3-32). Persons who frequently touched their faces frequently were more likely to get conjunctivitis (aOR=2.5 95%CI:1.02-6.1) while hand washing at arrival back at the dormitory/home was protective against conjunctivitis (aOR=0.3, 95%CI: 0.14-0.76). We observed that most dormitories were congested with pupils sleeping in triple decker beds, some adjacent beds had no space separating them. Hand washing facilities were also not well distributed.

**Conclusion:** The outbreak was likely facilitated by dormitory congestion and poor hand hygiene practices. Boarding scholars were most affected; regular hand washing and attending upper classes were protective. Education and awareness of good hand hygiene measures could mitigate the risk of similar outbreaks in the future.

**Key words:** Conjuctivitis, Outbreak, Uganda

**Cholera outbreak caused by consumption of contaminated lake water at Kasensero landing site, Kyotera District, April-May 2024**

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**Background:** On May 5, 2024, a cholera outbreak was confirmed at the Kasensero landing site in Kyotera District. We investigated the source, magnitude and risk factors of the outbreak to inform control measures.

**Methods:** We defined a suspected case as onset of watery diarrhoea in a resident of the Kasensero landing site from 1 April to 24 May 2024. A confirmed case was a suspected case with a positive stool culture for *V. Cholerae*. We reviewed health facility records and conducted an active case search in the community with the help of local leaders to identify cases. We did descriptive epidemiology to identify the possible risk factors and generate a hypothesis. We conducted a case–control study to identify risk factors using logistic regression. We conducted an environmental assessment to assess sanitation and hygiene practices at the landing site.

**Results:** We identified 64 cases (9 confirmed and 55 suspected) with an attack rate (AR) of 12/1,000 (64/5,300), and a case fatality rate of 3% (2/64). Fifty two percent (33/64) of the cases were male, and 38% (24/64) were aged 30-39 years. Kimwanyi parish was the most affected parish with 44 cases (AR=45/1,000). We observed latrines with compromised substructures and open defecation at the landing site. There was general water contamination of the lake water caused by the rains and flooding. The floating vegetation on the lake caused the stagnation of the lake water which likely sustained the contamination of the lake water which is the main source of livelihood at the landing site. Use of lake water for domestic purposes was significantly associated with cholera (aOR=4.0; 95% CI: 1.8–8.6) while boiling drinking water (aOR=0.4; 95% CI: 0.2–0.8) and having a pit latrine at home (aOR=0.3; 95% CI: 0.1–0.7) were protective.

**Conclusions:** The outbreak was caused by drinking unboiled/untreated lake water that had been contaminated by the floods that had washed down faecal matter to the lake at the landing site. We recommended boiling or treating lake water and construction of recommended pit latrines at the landing site.

**Keywords:** Cholera, Outbreak, Uganda

**An increased African Swine Fever burden to pig communities in Kangulumira Sub county, Kayunga District, June 2022**

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## Background

African swine fever (ASF) is a highly contagious and fatal viral disease of both domestic and wild pigs with mortality rates as high as 100%. On 8 June 2022, Kayunga District veterinary department was notified of suspected ASF in Kangulumira Sub county, Kayunga District, by the area assistant veterinary officer. We investigated to determine the magnitude of the upsurge, identify exposures for transmission and recommend evidence-based control and prevention measures.

## Methods

We defined a suspected case as onset of dullness or loss of appetite in a pig in Kangulumira sub county during June 1-30, 2022 with any one of the following signs: fever ($\geq$40.50C), vomiting, diarrhea, reddening or darkening of the skin, eye discharge, labored breathing and coughing, abortion, still births or weak litters, failure to stand, or sudden death . A confirmed case was a suspected case with positive PCR test results of ASF. We reviewed sub county surveillance reports and visited farms to identify cases. We also conducted two focus group discussions with veterinary extension workers and leading farmers in the affected areas to identify exposures.

## Results

We identified 173 animal cases: 122 (70.5%) suspected and 51 (29.5%) confirmed cases. Fifty four percent (n=93) were females and 148 (86 %) were aged $\geq$5 months. Case fatality rate was 91% (157/173). Out of the 36 villages in Kangulumira Sub county, the most affected villages were: Kisega with an attack rate (AR) of 60%, Nakatundu (AR=51%), and Kangulumira trading centre (AR=47%). Key informant interviews revealed that traders visiting the farm from previously infected areas, transportation of pigs for mating, stocking and restocking from previously infected areas, high density of small holder farmers, and sharing borders with ASF affected farms were the most likely exposures to ASF.

## Conclusion

Delay in identifying the upsurge and human mediated activities were the main drivers of this upsurge. We recommended training of farmers to reduce human-related risky behaviours driving infections in farms and intensifying sensitization of communities on prevention and control measures of ASF.

**Key words:** African Swine Fever, African Swine Fever Virus, Swine, Kangulumira, Kayunga

**Timeliness and completeness of monthly surveillance reporting on animal health diseases in Hoima District during March 2022 - March 2023**

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**Background:** In Uganda, animal disease reporting largely relies on passive surveillance with monthly reports submitted to the district by sub-county animal health workers. The district veterinary officer then submits the reports to the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF) through the Event Mobile Application (EMA-i) which facilitates real-time data entry, validation and analysis at national level. There is limited documentation on the extent of compliance with monthly surveillance reporting in Hoima District. We therefore evaluated the timeliness and completeness of monthly surveillance reports on animal diseases in Hoima District, Uganda from March 2022 to March 2023.

**Methods:** We analyzed data from EMA-I on monthly surveillance reports submitted by all the six sub-counties in Hoima District from March 2022 to March 2023. Timeliness was defined as the number of reports submitted by the deadline (10th day of the succeeding month) divided by the reports received. Completeness was defined as the number of submitted reports divided by the number of expected reports from one sub-county. Sub-counties with completeness or timeliness < 80% were regarded as having submitted incomplete or untimely reports respectively.

**Results:** Overall, during March 2022-March 2023, the median timeliness was 46.5% (range: 23.1%-53.8%), and median completeness was 50% (range: 38.5-61.5%) far below the 80% threshold. Timeliness and completeness rates varied across sub-counties. Kitoba (61.5%) and Kigorobya (61.5%) sub-counties had the highest completeness rates while Buseruka (38.5%) and Kigorobya Town Council (38.5%) had the lowest. While missing reports were noted in March to December 2022 for most of the subcounties, a substantial improvement in both timeliness and completeness was observed from January to March 2023 across all sub-counties. Notably, all six sub-counties achieved 100% completeness in their reports during this period. Additionally, Kitoba and Buhanika sub-counties also demonstrated 100% timeliness, while the other four sub-counties submitted two out of three reports (67%) on time. Furthermore, no missing reports were identified from January to March 2023, highlighting the overall progress in reporting practices.

**Conclusions:** Timeliness of monthly reporting on animal diseases in Hoima District was suboptimal and requires significant improvements to meet the 80% threshold. We recommended capacity building for sub-county animal health workers to improve reporting and further studies to explore specific factors contributing to reporting delays and incompleteness.

**Key words:** Timeliness, Completeness, Surveillance, Animal health workers, Hoima

# Breakout Session 2: Laboratory policy and systems

**Investigation of the suspected anthrax outbreak in Ibanda District Uganda, the laboratory experience, May 2023**

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**Introduction**: On March 24, 2023, the Public Health Emergency Operations Center, Ministry of Health Uganda was notified of a suspected anthrax outbreak in the Ibanda District, with 7 suspected human cases and one fatality. A rapid response team that included epidemiologists and laboratorians was deployed to investigate. The laboratorians specifically aimed to assess laboratory capacity and coordinate sample management, testing, and return of results to guide the response.

**Method**: We developed and used a laboratory assessment tool to assess the adequacy of human resources, sample collection supplies & procedures, transportation & referral services for advanced testing, and testing results management. We provided field-based rapid diagnostic tests (RDTs) for presumptive diagnosis in animals. We interviewed 3 district staff based on their role and utilization of the district laboratory system. These were: the district laboratory focal person (DLFP), the laboratory hub coordinator, and the district veterinary officer. In addition, we conducted observational evaluations and validation of the provided information by visiting 3 randomly selected hub-supported facilities, the coordinating laboratory hub, and the district veterinary laboratories. The data was analyzed descriptively using summaries and percentages.

**Results:** We found that Ibanda District sample transportation system was functional to support both human and animal specimen referral needs. The district had 3/32 (9%) staff trained in anthrax sample collection and did not have any RDT testing kits in stock. Personal protective gear and sample containers were available at the district laboratory hub. The district laboratory focal person had access to the results distribution system and was able to download and print results uploaded by reference laboratories. We conducted capacity building activities, including onsite training, mentorship, and orientation in anthrax sample handling procedures. Nine district laboratory staff were trained in anthrax sample collection, packaging, referral, and rapid testing using quick Vet Rapid Bovine Anthrax antigen test kits. These efforts improved district anthrax sample collection capacity of district laboratory staff from 3 to 12 of 32 (37%). The district team was able to collect 16 samples (10 blood &1 lesion from humans, 4 from soil, and 1 rumen content from the slaughter area) from suspected cases, grazing, and slaughter areas. The collected samples were successfully referred for advanced testing at Uganda Virus Research Institute using real-time PCR and the National Animal Diseases Diagnostics and Epidemiology Centre using Ultra Clean® Soil DNA Isolation Kit. Seven out of 11(63%) human samples and 2 soil samples were PCR-positive for

*Bacillus anthracis*. Sample turnaround time (TAT) improved from 3 to 2 days from collection to  the receipt of results from reference laboratories, except for the soil samples, which took an average testing TAT of 6 days.

**Conclusion:** An anthrax outbreak was confirmed in Ibanda District among humans. The provision of surge staff and team re-skilling ensured effective outbreak verification, confirmation, control, and management. This response demonstrated that effective laboratory strategies are critical to rapid outbreak detection, management, and control.

**Key Words** Uganda, Outbreak**,** Anthrax, *Bacillus anthracis* PCR, Laboratory

# Reduction of sample collection errors at the pre–examination phase in a public health facility in Kampala, March–August 2024

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**Background:** Sample collection errors are mistakes encountered when obtaining patient specimens and occur during the pre-examination phase of the laboratory's total testing process. These errors negatively impact the accuracy and reliability of laboratory test results which may consequently lead to misdiagnosis and or inappropriate treatment. Review of laboratory errors at a public health facility laboratory in February 2024 identified 219 laboratory errors with 51% (n=110) of the errors in the pre-examination phase. We conducted a quality improvement project to reduce the proportion of pre-examination errors at the public health facility by 50% between March-August 2024.

**Methods**: We constituted a laboratory quality improvement team at the public health facility. We conducted a baseline assessment to determine the process errors in the pre-examination phase. We used the fishbone technique to identify the root cause of the errors. We conducted focus group discussion to identify feasible test changes and implemented changes using the plan, do, check, act model. We presented our findings in tables and figures.

**Results:** At baseline in February 2024, we found a total of 219 sample collection errors of which 110 (50%) were at the pre-examination. We identified knowledge gap as the root cause of sample collection errors. We mentored 38 health workers (8 laboratorians, 24 nurses and 6 clinicians) on appropriate sample collection and management. We provided reference guidelines including standard operating procedures on sample collection and management. We instituted monthly support supervision visits with the staff and as a result of the implemented changes, the number of sample collection errors decreased by 64% between March-August, 2024.

**Conclusion:** Knowledge gap was the root cause of sample collection errors. Mentorship and provision of reference guidelines on sample collection and management decreased sample collection errors at the public health facility. We recommend regular mentorships and provision of laboratory guidelines to health workers during staff orientations and following annual staff rotations.

**Keywords:** Sample collection errors, pre – examination errors, mentorships.

# Improving Compliance to Healthcare Waste Segregation in a Private High-Volume Hospital, Kampala, Uganda Feb-July 2024

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**Background**: Effective healthcare waste segregation is essential for minimizing infection risks and environmental contamination. The Uganda laboratory waste management guidelines of 2021 recommend sorting highly infectious wastes into red bins, infectious wastes in yellow bins, sharps in safety boxes, chemical waste in brown bins and non-infectious into black bins. During the Infection Prevention and Control Committee (IPC) meeting at a private high-volume hospital A in Kampala, waste handlers reported improperly segregated waste stored at the designated site. We set out to improve the proportion of healthcare waste segregation-compliant units from 10% to 70% between January and July 2024 at the private high-volume hospital A in Kampala.

**Methods**: We conducted a baseline assessment on waste segregation in all 39 units at hospital A in January 2024. We adopted the existing IPC- committee of the Hospital. We conducted a five-why-root-cause analysis to determine the cause of non-compliance to healthcare waste segregation practices. We identified and introduced the most modifiable tested changes monthly to improve compliance with healthcare waste segregation. The changes were monitored for effectiveness using a quality indicator, with the goal of increasing the proportion of units complying with segregation practices from 10% in January to 70% in July 2024.

**Results:** The baseline assessment found that only 4(10%) out of 39 units at the hospital were complying with healthcare waste segregation practices. Irregular compliance inspection was identified as a primary cause of non-compliance with healthcare waste segregation practices. Initial training sessions and the introduction of waste segregation charts in January increased compliance to 13% (5 units). In February, we included routine inspections and on-the-job training, which raised compliance to 38% (15 units) in March. Continued routine inspections and on-the-job training further increased compliance to 54% (21 units) in April.The introduction of new bins in May raised it to 62% (24 units) and end of July, compliance was at 77% (30 units).

**Conclusion**: Implementing weekly inspections and healthcare waste segregation charts significantly improved compliance with waste segregation practices in the high-volume private hospital in Kampala. We recommended regular inspections and waste segregation guideline charts for all units generating healthcare waste in healthcare facilities to enhance and sustain compliance.

**Keywords:** Healthcare waste segregation

# Strengthening subnational laboratory response to disease outbreaks: a case of anthrax outbreak investigation in Kyotera District in Uganda, November 2023 - January 2024

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**Background:** Uganda, like most African countries still faces challenges of public health emergencies and inefficient laboratory response mechanisms, especially at the sub-national level. On November 17, 2023, the Ministry of Health through the Public Health Emergency Operations Centre received reports of 12 unusual human deaths registered from Kabira Sub County, Kyotera district. Case patients presented symptoms typical of anthrax disease. However, results returned negative from the testing laboratory with comments of poor-quality samples referred. We therefore set out to assess the Kyotera district laboratory team's capacity in sample collection and support the coordination of the laboratory response activities during the investigation, November 2023 to January 2024.

**Method:** We conducted a cross-sectional study to assess the Kyotera district's laboratory capacity. We adapted the WHO laboratory assessment tool to collect data on laboratory sample collection and referral capacity, the presence of a district-costed laboratory response plan, an active district laboratory pillar, a sample tracking register, the availability of emergency laboratory supplies, and one health multi-sectoral involvement in the response. We used findings to design and implement interventions to enhance coordination and laboratory response during the investigation.

**Results:** Twenty-five (25) laboratory staff from 16 health facilities took part in the exercise. Only 1 (4%) staff had been trained and skilled to collect package, and ship outbreak samples for reference testing. There was no costed district laboratory response plan in all facilities, no active laboratory pillar to support planning and response activities, no sample register to aid sample tracking, and no samples collected from animals and the environment. To address these gaps, we conducted facility-based mentorship for the 24 laboratory staff and a sub-county veterinary assistant on collection, packaging, and the necessary infection, prevention, and control measures. The district laboratory pillar led by the district laboratory focal person was activated.

**Conclusion:** The district had limited laboratory capacity to respond to public health emergencies. The facility-based mentorship strengthened the district laboratory capacity, which improved the overall outbreak response. We recommended continuous mentorship of laboratory staff at the sub-national level for effective laboratory outbreak preparedness and response.

# Staffing needs assessment of the health laboratory workforce in selected health facilities in Lango Sub-region, Uganda

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**Introduction:** The health laboratory workforce (HLW) plays a pivotal role in achieving Primary Health Care, Universal Health Coverage, International Health Regulations and Sustainable Development Goals for health in a country. Shortage in this workforce compromises the quality of test results used for clinical management, public health intervention and policy development. We assessed the staffing needs of the health laboratory workforce in three public health facilities in Lango Sub-region in Uganda, namely, Agali Health Center III, Ogur Health Center IV and Apac General Hospital from July 2022 to June 2023..

**Methods:** We collected and analyzed data on staffing needs using the Workload Indicator for Staffing Needs (WISN) assessment tool. This was a mixed-methods study. Quantitative data on existing staffing levels of HLW by cadre was obtained from the staff list from the districts; data on recommended staffing levels in Uganda; 4 laboratory staff at H/C III, 9 laboratory staff at H/C IV and 15 lab staff at General Hospital, was got from the Ministry of Public Service guidelines on staffing structure for HLW, and data on laboratory testing was abstracted from the health management information system registers 105 and 108 for the same period. Laboratory staff requirement was calculated step-by-step based on workload. Activity standards (the time it takes a laboratory to conduct core activities and associated activities) were applied to each workload component. This was based on the same standards in all similar health facilities, considering the available working time (amount of time available in a year, per cadre, for delivering health services). The differences between the actual and calculated number of health personnel were calculated to show the level of staffing shortage or surplus for a particular cadre in a given health facility. The ratio of the actual to the required number of staff was used to calculate the WISN ratio. To determine workload pressure, the surplus/deficit staff was expressed as a percentage of the staff required by WISN. The qualitative component involved administering key informant interviews (KII) to district laboratory focal persons, human resource officers and laboratory managers to identify possible factors affecting HLW in Lango sub-region to triangulate the quantitative results obtained. Transcripts were transcribed and coded according to pre-conceived themes. We presented our findings as proportions showing the WISN ratio and workload pressure.

**Results:** The WISN calculation showed that there was a surplus of 2 laboratory technicians with WISN ratio of 1.5 and no workload pressure (-50%) in Agali Health Center III; a shortage of 1 laboratory assistant with WISN ratio of 0.8 and high workload pressure (25%) in Ogur Health Center IV; as well as a shortage of 4 laboratory assistants, 1 laboratory technician and 1 laboratory technologist with WISN ratio of 0.5 and high workload pressure (55%) in Apac General Hospital. From the KIIs identified factors negatively affecting HLW in Lango Sub-region included high workload perception, low staffing levels, inappropriate laboratory infrastructure, and unsuitable equipment.

**Conclusion:** The study highlighted the imbalances of staffing in the selected health facilities including surplus and excess staff. There is an urgent need to address human resource management issues in the district to ensure efficient delivery of health services. Further WISN assessment for all the public health facilities in Lango will help to improve the distribution of the laboratory workforce in the region.

**Keywords:** Health laboratory workforce, Medical laboratory professionals, Workload Indicator for Staffing Needs (WISN)

# Breakout Session 3: Malaria and HIV

**Characteristics of male sexual partners to Adolescent Girls and Young Women attending the outpatient clinics at Fort Portal Regional Referral Hospital, Uganda**

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**Background:** In Uganda, the HIV incidence among adolescent girls and young women (AGYW) aged 15-24 years has remained high. Despite the several studies done in relation to AGYW and HIV, little is known about their male sexual partners (MSP). We characterized MSP of AGYW in Fort Portal Regional Referral Hospital, located in South Western Region of Uganda in June 2024.

**Methods:** We conducted a cross-sectional study among AGYW attending the outpatient clinic at Fort Portal Regional Referral Hospital in Fort Portal City. We used systematic sampling and every 5th AGYW at the outpatient unit was approached for enrollment into the study. We collected data on demographic and other characteristics of both AGYW and their MSP (most recent) using a semi-structured researcher-administered questionnaire. We summarized the data on AGYW and their MSP characteristics as frequencies and proportions.

**Results:** A total of 355 AGYW participated in the study. Of these, 214(60%) were aged 20-24 years, 261(74%) were in sexual relationships, and 43(12%) reported being HIV positive. Of the 261 AGYW in male sexual relations, 189(74%) reported having MSP who were older than them with majority 141(75%) aged 25 years and above. A total of 198(76%) of the AGYW reported having MSP who disclosed their HIV status to them, of whom 27(10.3%) were HIV positive. Of the 27 AGYW with HIV positive MSPs, 18(7%) reported being in sero-discordant relationships. More than two-thirds 181(69%) of the AGYW reported having circumcised MSP. 57(22%) of the AGYW reported having MSPs who were boda-boda riders; 84(32%) used recreational drugs prior to sexual encounter; and only 13(5%) consistently used condoms.

**Conclusion:** A high number of AGYW reported being HIV positive with some in sero-discordant relationships. AGYW were in sexual relationships with MSPs who were older, most being boda-boda riders with limited use of condoms suggesting the need for Ministry of Health (MoH) to scale up HIV prevention programs among boda-boda riders as a priority population that is likely to transmit HIV to AGYW. MoH may need to strengthen social behavior change communication programs on correct and consistent condom use among AGYW and other priority populations.

**Keywords:** Adolescent Girls and Young Women, Uganda, and Male Sexual Partners

# Trends and distribution of Malaria in Pregnancy in Uganda: analysis of surveillance data, 2015–2023

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**Background**: Malaria in Pregnancy (MiP) is associated with an increased risk of feto-maternal adverse outcomes. Pregnant women with malaria are at a higher risk for severe anemia and maternal death. We evaluated the trends and distribution of MiP from 2015–2023 to inform interventions to reduce MiP in Uganda.

**Methods:** We analyzed national secondary data on malaria in pregnancy (MiP) from monthly surveillance reports from the District Health Information Software (DHIS2) for 2015–2023. We defined MiP as laboratory-confirmed malaria in a pregnant mother. We calculated MiP incidence by dividing the number of MiP outpatient cases by the total number of first antenatal visits per 1,000 pregnant women. The incidence of MiP admissions was computed as a proportion of MiP cases that were admitted per 1,000 population. The incidence of MiP deaths was calculated as the proportion of MiP cases that died per 1,000 population. We used the Mann-Kendall test to assess MiP trends and described the spatial distribution by region and district.

**Results**: A total of 2,808,426 MiP cases were reported during 2015–2023. The overall MiP incidence increased from 15% in 2015 to 21% in 2023(p=0.02). The incidence of MiP among women aged 10-19 years increased from 29% to 34% (p=0.013) while for those ≥20 years increased from 15% to 18% (p=0.017). There was no trend in the incidence of MiP admissions and deaths. Among the 15 regions of Uganda, Busoga (p=0.001), Teso (p=0.029), and WestNile (p=0.003) had increasing trends in MiP while the Karamoja region had a decreasing trend (p=0.0059). Incidence of MiP increased at Health Center III (p=0.029) whereas Regional Referral Hospitals reported a decreasing trend (p=0.036). An increasing trend of MiP was noted at public health facilities (p=0.029).

**Conclusion**: The incidence of MiP in Uganda increased during 2015–2023 suggesting higher risks of malaria-related complications during pregnancy. The burden of MiP was much higher among teenage and adolescent mothers. MiP was significantly higher at health center III and public health facilities. Further investigation into the reasons for an increasing incidence of MiP in Busoga, Teso, and West Nile could provide insights for programming to reduce the burden.

**Keywords**: Malaria in pregnancy, Incidence, Trends, Uganda

**Trends and distribution of HIV incidence rates among children aged 0-14 years in**

**Uganda, 2015–2023**

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**Background:** Uganda aims to achieve zero HIV transmission by 2030. However, HIV infections among children still accounted for 11% of new cases in 2023. We examined trends and distribution of HIV incidence among children in Uganda between 2015−2023 to inform HIV prevention strategies towards HIV elimination efforts.

**Methods:** We analyzed routinely reported HIV surveillance data from the electronic District Health Information System version 2 (DHIS2) between 2015−2023. DHIS2 collects data from the paper-based monthly HMIS data that captures aggregate data on the number of children (0–14 years) who tested HIV positive. HIV incidence was calculated as new HIV cases divided by the population at risk by region, sex, and age group per 100,000 population annually. The significance of trends was determined using Mann-Kendall test.

**Results:** A total of 63,599 new HIV infections occurred among children aged 0–14 years between 2015−2023, with an average of 7,128 infections 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 incidence rates (69/100,000 in 2016, 30/100,000 in 2020, 28/100,000 in 2023) compared to males (55/100,000 in 2016, 25/100,000, 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 compared 5−14 years (28/100,000 in 2015 & 24/100,000 in 2023). Kalangala District (117/100,000 in 2015, 83/100,000 in 2019, 120/100,000 in 2022) persistently had high HIV incidence rate throughout the study period. Districts: Kasese, Kyenjojo, Luwero, and Karenga; and cities: Fort portal, Gulu, Lira, and Jinja initially declined in HIV incidence rate from 2015 to 2020, then increased from 2020 to 2023.

**Conclusion:** HIV incidence rate among children aged 0−14 years reduced significantly from 2015 to 2023. Children <5 years and females had higher HIV incidence rates. 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.

**Keywords:** HIV infections, epidemiology, prevention, transmission, incidence

**Evaluating outcomes of mass drug administration for malaria during the Ebola outbreak in Kasanda District, Uganda, November 2022–January 2023**

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**Background:** Ebola and malaria both present as febrile illnesses, making diagnosis difficult. During Ebola Virus Disease (EVD) outbreaks, suspected malaria cases are often reported as Ebola alerts which strains the health system thus increasing malaria-related morbidity and mortality. Mass Drug Administration (MDA) of antimalarials can reduce malaria morbidity in emergencies like EVD outbreaks. During the 2022 EVD outbreak in Mubende and Kasanda Districts, round one of MDA was implemented. We aimed to assess the outcome of MDA in Kasanda District.

**Methods:** We abstracted data on coverage and impact of round one of MDA for malaria from the antimalarial Dihyroatemesisnin-Piperaquine (DP) drug distribution records tool, EVD alerts record tool and District Health Information System 2 (DHIS2) for the 5 implementation sub-counties of Kasanda District. Data on trends of malaria morbidity indicators (total malaria cases, total positivity rates, OPD suspected malaria fevers), EVD alerts and coverage during the pre-MDA (weeks 33-week 48, 2023) and intra-MDA (week 49, 2023-week 6, 2024) periods were obtained from the above listed tools. We estimated MDA coverage as the proportion of persons who received DP. MDA outcomes on malaria morbidity indicators and EVD alerts during pre-MDA versus intra-MDA period was estimated as a relative percent change using interrupted time series regression model.

**Results:** Round one MDA coverage in the targeted 5-subcounties was 88% (122, 704/139,437). The total malaria cases decreased by 6.7% (95% CI 4.2% -12.3%) during week 1, and further declined in week 6 post-MDA by 43% (95% CI 34% - 52%). Test positivity rate declined by 13% (95% CI 7% -16%) during week 3 and declined further throughout all MDA weeks. Outpatient cases with suspected malaria fevers decreased by 23% (95% CI 17% -35%) during week 1 and declined further throughout MDA weeks. The Ebola alerts decreased by 8.8% (95% CI 5.2% -15.1%) at week 1 and declined further 79% (95% CI 63% - 88%) by MDA week 6.

**Conclusions:** One round of MDA during EVD in Kasanda District resulted in significant reduction of malaria morbidity indicators. The MDA implementation approach is an appropriate public health intervention in the context of EVD epidemic outbreak especially in malaria endemic areas like Kasanda District.

**Keywords:** Mass Drug Administration, Ebola Virus Disease, Malaria trend indicators.

# Increasing cases of malaria in Kampala City, Uganda: A Descriptive analysis of surveillance data, January 2020–December 2023

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**Background:** Uganda ranks third in the global malaria burden. The country is experiencing rapid urbanization which predisposes the urban population to malaria transmission risks. Kampala City is the largest urban settlement in Uganda with poor housing in slums, encroachment on wetlands, and road construction with water stagnation which are high-risk factors for malaria transmission. We describe the epidemiology of malaria in Kampala City to inform planning and malaria service delivery for city residents.

**Methods:** We conducted a descriptive analysis using secondary data abstracted from the District Health Information System-2 (DHIS-2) on patients tested for malaria, hospital admissions and reported deaths. Data represented a total of 1,936 reporting health facilities, both public and private in Kampala City, between 2020 and 2023. We determined the frequency of confirmed malaria cases, estimated incidence per 1000 population per year by gender, age group, and test positivity. We used the Mann-Kendell test to test for the significance of the trends.

**Results:** Between 2020 and 2023, there were a total of 680,955 malaria cases, 25,836 malaria admissions, and 614 malaria-related deaths in Kampala City. Malaria cases increased by 29% from 144,697 to 203,842 (p=0.0001) and 55% for admissions from 4,319 to 9,592 (p=0.0001). Most (57.9%) admissions were among persons >5 years. Malaria incidence increased from 165 to 233/1,000 (p=0.0001) and was higher in females (405/1,000); adults ≥20 years (420/1,000) and in the Central Division (368/1,000). The mean monthly malaria test positivity rate from 2020 to 2023 was 17%. Most deaths were reported in children under 5 years (73%, n=448).

**Conclusion:** Malaria cases and incidence increased in Kampala City between 2020 and 2023 which is likely a consequence of poor housing and sanitary conditions which easily promote mosquito breeding potential for malaria. We recommend targeting children under 5 and hotspot mapping to identify and characterize foci of malaria transmission in Kampala City to facilitate targeted interventions.

**Keywords:** Malaria, Kampala City, Uganda

**Improving reporting of HIV commodity stock status in an ART-accredited site in Kampala, March to August 2024**

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**Background**: HIV commodity stock status monitoring refers to routine tracking of current quantity of available antiretrovirals (ARVs) and HIV test kits at a health facility. To inform stock status and redistribution plans, the Ministry of Health monitors weekly HIV commodity stock status across the 31 HIV-accredited sites in Kampala using the Real-time ARV Stock Status monitoring tool (RASS). However, by end of March 2024, only 4 (12%) sites had submitted all their reports for the first quarter. We conducted a continuous quality improvement project to improve weekly reporting from 0% in March 2024 to 100% by August 2024 at one of the none reporting ART-accredited site in Kampala, Uganda.

**Methods**: We adopted quality improvement team members in charge of RASS for the project at the selected ART-accredited site. We conducted a baseline study using data abstracted from the RASS dashboard in March 2024. We identified factors leading to non-reporting using the fishbone cause analysis technique and identified the tested suggested changes to improve reporting using the 5 why technique. We used the Plan Do Check Act (PDCA) method to implement the tested changes.

**Results**: At baseline in March 2024, the selected ART-accredited site submitted zero (0%) reports. The themes generated included personnel, management, resources, and environment. We identified lack of staff orientation under the personnel theme as the most modifiable root cause for non-reporting. We orientated 2 newly transferred RASS users in April 2024 which improved reporting from 0% to 80% in May, 2024. We then introduced weekly WhatsApp reminders, further increasing percentage reports from 80% to 100% by August,2024.

**Conclusion:** Orientation of new personnel on weekly RASS reporting and weekly reminders contributed to the improvement of reporting in the selected ART accredited site. We recommend continuous orientation and refresher training of new personnel and weekly reminders to ART- accredited sites in Kampala to improve HIV commodity reporting.

**Keywords:** RASS**,** HIV commodities

# Breakout Session 4: Vaccine Preventable Diseases

**Measles-Rubella dose 2 vaccination uptake and associated factors among children aged 18–24 months in Namutumba district, Uganda, April 2024**

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**Background**: Measles remains a major public health concern, especially in regions with vaccination coverage rates below 95%. Two doses of Measles-Rubella vaccine (MR) are administered to children <2 years; dose 1 (MR1) is administered at 9 months while dose 2 (MR2) at 18 months after birth. In 2023, MR2 uptake was 23% in Namutumba district, compared to the national uptake of 35%, both falling short of the ≥95% national target. We assessed MR2 vaccination uptake and identified factors affecting it among children aged 18–24 months in Namutumba district in April 2024 to guide targeted interventions.

**Methods**: We conducted a cross-sectional study in Namutumba district using a multi-stage sampling procedure. At first stage, we randomly selected six out of 20 sub-counties, at second stage we selected three villages within each selected sub-county using simple random sampling. At third stage, we systematically sampled households with children aged 18–24 months in each village, using lists of households provided by the village health team registers. Within each selected household, we identified one caregiver of a child aged 18–24 months to interview using a structured questionnaire. We estimated the MR2 uptake by calculating the proportion of children who received the vaccine according to their vaccination cards. We summarized sociodemographic characteristics, exposure factors and vaccine status using frequencies and proportions. We used logistic regression model to identify factors associated with MR2 vaccination status using adjusted odds ratios (AOR) and their 95% confidence intervals (CI) to summarize effect measures. Weights were calculated based on probabilities of selection at different levels of sampling and were applied in analysis to ensure sample representativeness of the target population.

**Results**: A total of 350 caregivers from 350 households were interviewed. Most caregivers (86%, n=300) were mothers of the children. The median age of the caregivers was 29 Years, IQR (17, 62) years. The majority (54%, n=188) had attained primary education level. The estimated MR2 coverage was 22% (n=77). The caregiver's level of education (aOR=1.8, 95% CI 1.4–3.0), awareness of MR vaccination (aOR=9.9, 95% CI 2.5–40), and delivering from a health facility (aOR=6.7, 95% CI 1.5–30) were significantly associated with MR2 uptake.

**Conclusion**: The MR2 uptake in Namutumba district was low compared to the national target of ≥95%. Caregivers who had lower than secondary education, those unaware of MR vaccination, and those who did not deliver from a health facility were significantly associated with incomplete vaccination against measles. There is need to create awareness campaigns for community emphasizing the importance of the MR2 vaccination.

**Key word**: Measles-Rubella vaccination, Risk factors, cross-sectional study, Vaccination uptake, caregivers.

# Measles outbreak imported through the porous border in Moroto District, Uganda, March–July, 2024

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**Background:** On 26 June 2024, the Uganda Ministry of Health was notified of a measles outbreak in Moroto District. We investigated the outbreak to determine its magnitude, identify the source, identify risk factors for transmission, and recommend evidence-based control measures.

**Methods:** We defined a suspected case as onset of fever and maculopapular rash, plus ≥1 of cough, coryza, or conjunctivitis in a resident of Moroto District from 15 March to 23 July 2024. A confirmed case was a suspected case with a positive measles-specific IgM test. Cases were identified through review of health facility records and active case search within the health facilities. We calculated case fatality rate (CFR) and attack rate (AR) by sub-county and age group. We conducted an unmatched case-control study (1:2) and used logistic regression to identify risk factors. We estimated the vaccine effectiveness (VE) of measles vaccine from adjusted odds ratio (aOR) associated with vaccination (VE=1-aOR) % and vaccination coverage (VC) from percentage of vaccinated controls.

**Results:** We identified 236 case-patients (223 suspected cases, 13 confirmed). There were five deaths (CFR=2%) among suspected cases. The index case was a 10-month-old child who had traveled with the mother from the western Turkana Region of Kenya, where a measles outbreak was ongoing. The overall AR was 19/10,000. Lotisan Sub-county (AR=50/10,000) and children <1-year-old (AR=194/10,000) were the most affected. Of the case-patients, 50% were vaccinated compared to 91% of controls; being vaccinated was 89% protective (aOR=0.11, 95%CI=0.03-0.4). Among the cases, 45% had visited a health facility 7-21 days prior to their rash onset compared to 18% among controls; visiting a health facility 7–21 days before the onset of rash increased the odds of measles 3.8 times (aOR=3.8, 95%CI=1.3-11). Of the case-patients, 29% had malnutrition compared to 15% of controls; malnutrition increased the odds of measles by 6.1 times (aOR=6.1, 95%CI=1.3-27). Estimated VC was 67%; 82 out of the 122 controls were vaccinated against measles, and VE was 89% (95%CI=60-97); 50% of case-patients were vaccinated compared to 91% of controls.

**Conclusion:** The outbreak was likely imported from Kenya and was propagated by low VC, nosocomial infections and malnutrition. Improved triage, mass vaccination campaigns for children aged 6–59 months and strengthened cross-border disease surveillance could prevent future similar outbreaks.

**Keywords:** Measles outbreak, Nosocomial infection, Malnutrition, Vaccine-effectiveness, Vaccine-coverage

# Factors associated with second dose measles-rubella vaccine uptake among children aged 18–59 months in selected hospitals, Uganda, June-July 2024

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**Introduction**: Uganda introduced the second dose of measles rubella (MR2) vaccine in 2022 but continues to register low MR2 coverage (21%)which is below the 95% WHO target. As of March 2024, 15 measles outbreaks had been reported in 15 districts across the country with many of the cases reported among children under 5 years. We assessed factors associated with MR2 uptake among children aged 18–59 months in Uganda during June─July, 2024.

**Methods:** We conducted a mixed methods cross-sectional study at 11 selected hospitals in Uganda.  Using the Fleiss formula, we computed a sample size of 465 caregivers of children aged 18–59 months, seeking services at the hospitals' outpatient department (OPD). Participants were proportionately distributed across the hospitals, and systematically selected at the OPD. Data on sociodemographic characteristics of caregivers and children, knowledge, attitude, practices regarding immunization, and MR2 uptake were collected using an interviewer-administered semi-structured questionnaire. We conducted 5 key informant interviews (KIIs) using a KII guide among stakeholders in the immunization program for each district. MR2 uptake was calculated as the percentage of children aged 18–59 months who had received MR2 by the time of the study. We summarized participants' characteristics using frequency distributions, and determined factors associated with MR2 uptake using modified Poisson regression. Qualitative data was transcribed, open-coded to generate subthemes and themes using the inductive approach.

**Results:** We interviewed 465 caregivers with the majority (92%) being female; 77% were aged 25-49 years and 77% were married. Among the 465 children, 47% were aged 18-24 months while 339 (73%) had received MR2. Delivery at health facility (*a*PR=1.47; 95%CI=1.02-2.13), and being knowledgeable about immunization services (*a*PR=1.28; 95%CI=1.16-1.43) were associated with MR2 uptake. Facilitators for MR2 uptake were availability of vaccines, outreach immunization services, and health education. Barriers were inadequate community awareness, poor physical access to vaccination centres and knowledge gap among health care providers.

**Conclusion**: Although MR2 uptake was higher than the national average, it was below the recommended 95% target required to reach herd immunity. To improve MR2 uptake, we recommend that the district health authorities increase their efforts towards encouraging

mothers to deliver at health facilities as well as disseminate targeted awareness messages on MR2 in order to improve knowledge and attitude of caregivers towards immunization.

# Adverse event or not: An investigation of a death following yellow fever vaccination in Nakapiripirit District, April 2024

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**Background:** Adverse events following immunization (AEFIs) are medical occurrences post-vaccination that may or may not be causally related to the vaccine. In April 2024, Uganda conducted a yellow fever vaccination campaign targeting persons aged 1–60 years.  The national AEFI committee received an alert of the death of a 3-year-old male, 3 days post vaccination in Nakapiripiriti District, Karamoja Region. We investigated the death to establish its cause and determine the classification of the AEFI.

**Methods:**  We reviewed clinical records of the patient to obtain laboratory findings, diagnosis and the prognosis of the disease. We interviewed the caregiver and health workers to obtain details of the vaccine administered, cold chain and immunization practices. We conducted a traceback of events before and after vaccine administration, and used the WHO AEFI causality assessment tool to determine the AEFI classification of the case.

**Results:** The case-patient received the yellow fever vaccine on 3 April 2024, and developed high grade fever, vomiting, restlessness and purulent skin rash the next day. Laboratory investigations were positive for a viraemia, bacteremia and malaria. Despite management using antibiotics and artesunate, the child's condition worsened with confusion and restlessness. A repeat malaria test on 6 April 2024 was negative for malaria; the child later died the same day. The traceback revealed that the child was bitten by a suspected rabid stray dog 2 months prior to the vaccination. He was bitten on his index finger and was unable to receive the anti-rabies vaccine from any of the community health facilities.  A review of storage, handling and administration of the yellow fever vaccine revealed that they were done according to the recommended guidelines. The WHO AEFI causality assessment determined that the AEFI was coincidental and linked to an underlying rabies infection.

**Conclusion:** The death following yellow fever vaccination was not linked to the vaccine, but suspected to have been caused by rabies virus. Investigation of AEFIs is encouraged to allay fears and myths about vaccination. In addition, the Ministry of health should avail anti-rabies vaccines to health facilities. Animal control authorities should prioritize continuous community sensitization to adhere to recommended vaccination of pets and eliminate stray dogs and cats from the communities.

**Key words:** Yellow fever vaccine, adverse events following immunization, rabies, death

# Measles outbreak investigation, Terego District, Uganda, May-June 2024

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**Background:** During January–May 2024, Uganda reported eight measles outbreaks, including one in Terego District on April 30. We investigated to assess the outbreak scope, risk factors, vaccine effectiveness (VE) and vaccine coverage (VC) and recommend evidence-based control measures to prevent future outbreaks.

**Methods:** We defined a suspected case as acute onset of fever, rash and ≥1 of cough, coryza and conjunctivitis in a resident of Terego District from 1 February to 31 May 2024. A confirmed case was a suspected case who tested positive for measles-specific IgM antibodies. We line-listed cases by reviewing health facility records and active case search in communities. We calculated attack rates(AR) by sex and age-group. We conducted a 1:1 unmatched case-control study in the most affected sub-county of Leju Town Council. Logistic regression was used to determine risk factors for the outbreak. VE was calculated using the formula VE=(1-aOR)%, where aOR were the odds of having been vaccinated against measles. VC was the proportion vaccinated among controls.

**Results:** Overall, 136 cases were line-listed (4 confirmed and 132 suspected). There were no deaths. The index case was a 36-year-old female who had travelled from Arua City where she attended to a relative's child who had measles at a health facility (HF). Females(AR=6.4/10,000) were more affected than males(AR=4.2/10,000)(P=0.2), and children 0-6 months (AR=22/10,000) were more affected than 7-11month-olds(AR=10/10,000)(P=0.03). Most case-persons (78%; 63/80) had cough, 60%(48/80) coryza and 36%(29/80) conjunctivitis. Vaccination by 34%cases was 60%(aOR=0.4,95%CI=0.2-0.8) protective, while 40%cases who visited HFs (aOR=4.4,95%CI=1.4-14) and 74%cases who attended public gatherings (aOR=4.9,95%CI=2.01-12) were at risk of developing measles. The approximate VE was 60% and VC was 71%.

**Conclusion:** The measles outbreak was imported from neighboring Arua City with transmission driven by nosocomial infections and attendance of public gatherings. We recommended isolation of suspected cases.

**Key words**: measles, risk factors

**Investigating a measles outbreak facilitated by non-vaccination in Kakumiro District, Uganda, February–May, 2024**

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**Background:** On April 7, 2024, the Uganda Ministry of Health was notified of a measles outbreak in Kakumiro District involving death of a suspected case. We investigated to determine the scope of the outbreak, assess risk factors for disease transmission, and recommend evidenced-based interventions.

**Methods:** We defined a suspected case as onset of fever and maculopapular generalized rash with ≥1 of cough, coryza, or conjunctivitis in any resident of Kakumiro District from February 1–May 30, 2024. A confirmed case was a suspected case with laboratory confirmation for measles Immunoglobulin M (IgM) antibody. We conducted active case search at health facilities and communities to line-list suspected case-patients. We conducted a descriptive analysis and a case-control study at a ratio of 1:1 with 100 cases selected randomly from the line-list of case-patients. We conveniently selected controls from persons of the same village and age group as the case-person. We identified risk factors using unconditional logistic regression and estimated vaccine coverage using the percentage of eligible controls who had received ≥1 dose of measles vaccine. We calculated Vaccine Effectiveness (VE) as VE= $1 - OR_{adj} \times 100\%$, where $OR_{adj}$ is the adjusted odds ratio associated with having received ≥1 dose of measles vaccine.

**Results:** We identified 188 suspected cases, including 6 (3.2%) confirmed and 1 (0.5%) death. The overall attack rate (AR) was 67/100,000 persons. Children aged <9 months (AR=232/100,000) and those aged 9months–≤5 years (AR=177/100,000) were the most affected. The most affected subcounties were Kisengwe (AR=313/100,000), Kasambya (AR=126/100,000) and Kakumiro Town Council (AR=110/100,00). Non-vaccination (aOR=2.9, 95%CI: 1.1-7.6), exposure to a measles case-patient in a health facility during exposure period (aOR=47, 95%CI: 6.09-369) and exposure to measles case-patient in the same household during exposure period (aOR=9.3, 95%CI: 2.9-30) were associated with measles infections. Vaccine coverage was 88% (95%CI: 79%-94%) and vaccine effectiveness was 65% (95%CI: 13%-91%). We observed crowding and lack of triaging/isolation in health facilities.

**Conclusions:** This outbreak was facilitated by non-vaccination and propagated by exposure to infected persons in crowded health facilities and households. We recommended to MoH to conduct a supplementary immunization activity that included children <9 months in the target group. Triaging and isolation of case-persons might help to reduce the spread of measles in future outbreaks. There is also need to develop strategies to improve vaccine effectiveness in the district.

**Keywords:** Measles, vaccine coverage, vaccine efficacy, outbreak, Uganda

# Trends and distribution of Rift Valley fever outbreaks in Uganda, 2016–2023

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**Background:** Rift Valley fever (RVF) is a viral zoonosis which occurs sporadically in Uganda. Several RVF outbreaks have been reported in Uganda but little is known about its patterns and distribution. We evaluated the trends and spatial distribution of RVF outbreaks in Uganda from 2016–2023 to guide programming.

**Methods:** We analyzed RVF surveillance data from the electronic Public Health Emergency Management (ePHEM) database of Uganda Ministry of Health (MoH) from 2016–2023. The database is an open-source, multilingual, modular application used by the National Public Health Emergency Operation Centre (PHEOC) to manage all the outbreaks in the country. The Integrated Disease Surveillance and Response (IDSR) guidelines define a confirmed RVF case as any patient testing positive for either anti-RVF immunoglobulin M(IgM) Enzyme Linked Immunosorbent Assay (ELISA) antibodies or Reverse Transcriptase Polymerase Chain Reaction (RT-PCR) test. We abstracted data of all RVF cases reported between 2016–2023. We did descriptive analysis and tested trends using the Mann-Kendall test.

**Results:** Forty-three RVF outbreaks were reported resulting in 340 cases (116 confirmed) and 42 deaths in Uganda from 2016–2023. The western region reported the highest number of cases 302(89%), and deaths 31(74%). There was a non-significant increase (p=0.73) in the number of RVF outbreaks reported from 1 in 2016 to 8 in 2023 with most outbreaks (13) reported in 2018. RVF outbreaks occurred in all four regions of the country, with the highest number reported in the western region 27(63%), followed by the central region 12(28%). Twenty-six (60%) of the outbreaks were reported in the cattle corridor districts with Mbarara 4(9%) and Kiruhura 4(9%) districts reporting the highest number of outbreaks. Most outbreaks 29(67%) were reported during the annual dry season of January– February and June–August.

**Conclusion:** There was an increase in the number of reported outbreaks of RVF in Uganda annually since 2016. The continued spread indicates a need for more widespread risk communication about RVF in both humans and animals particularly in regions and districts reporting a high number of outbreaks. We recommend strengthening RVF surveillance during the rainy season to better understand the true burden of the disease.

**Keywords:** Rift Valley fever, outbreak, trend, spatial distribution, Uganda

**Anthrax outbreak associated with consumption and handling of meat from cattle that suddenly died in Kyotera, Uganda, June–December 2023**

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**Background:** In November 2023, Kyotera District reported a strange illness, characterized by itching, rash, swelling, and skin lesions which was later confirmed as anthrax. We investigated to assess its magnitude, identify potential exposures, and propose evidence-based control measures.

**Methods:** A suspected cutaneous anthrax case was defined as acute onset of skin itching or swelling plus ≥2 of: skin reddening, lymphadenopathy, headache, fever or general body weakness in a resident of Kabira sub-county, June–December 2023. A suspected gastrointestinal anthrax case was defined as acute onset of ≥2 of: abdominal pain, vomiting, diarrhea, mouth lesions or neck swelling in a resident of Kabira sub-county, June–December 2023. A confirmed anthrax case was a suspected case with *Bacillus anthracis* PCR-positive results. To identify cases, we reviewed medical records and conducted community active case-finding with the help of village health team members. We conducted a case-control study and used logistic regression to identify risk factors of anthrax transmission.

**Results: Results:** We identified 63 cases (46 suspected and 17 confirmed); 48 (76%) were male. Of these, 55 cases (87%) were cutaneous and 8 (13%) were gastrointestinal, with a mean age of 42 years. Overall attack rate was 3.1/1,000; males were more affected (AR=4.5/1,000) than females (AR=1.5/1,000). Case-fatality rate was 19% (n=12). Among the suspected cases, 18 (29%) sought care from health facilities; 33 (52%) were managed by traditional healers. Compared to individuals who neither ate meat nor had contact with dead animals, those who had contact and consumed meat had higher odds of anthrax infection (OR=20.9, 95% CI: 8.8-49.8), followed by those who only consumed meat (OR=5.81, 95% CI: 2.12-15.9).

**Conclusion:** The anthrax outbreak in Kyotera District was primarily attributed to the consumption and handling of meat from cattle that had suddenly died. Poor health-seeking behavior and seeking care from traditional healers likely contributed to the high CFR. Implementing inspection protocols for cattle before slaughter, instituting widespread vaccination campaigns against *Bacillus anthracis* in livestock and community sensitization on healthcare seeking might prevent future outbreaks.

**Keywords:** Anthrax, Cutaneous, Gastrointestinal, Outbreak, Uganda

**Anthrax outbreak associated with sleeping on hides of cattle that died suddenly in Amudat District, Uganda, Dec 2023–Jun 2024**

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**Background**: On December 28, 2023, a suspected case of anthrax was reported at Karita Health Centre IV in Amudat District. Samples collected and tested confirmed an anthrax outbreak later in March, 2024. We investigated to assess its magnitude, identify exposure sources, and recommend control measures.

**Methods:** We defined a suspected cutaneous anthrax case as an individual with skin lesions (vesicles or eschars) plus $\geq 2$ of the following symptoms: itching of skin, reddening of skin, swelling around the lesions, or regional lymphadenopathy from December 2023 to June 2024. A confirmed case was a suspected case that tested PCR-positive for *Bacillus anthracis*. We identified cases through house-to-house search, patient record reviews, and snowballing among cases. Human and animal samples were collected and tested, alongside an environmental assessment. An unmatched case-control study compared 40 case-persons with 120 control-persons to identify factors associated with anthrax transmission. We used logistic regression to identify the risk factors.

**Results:** We identified 102 suspected cases (7 confirmed); none died. All cases were cutaneous anthrax. The outbreak lasted 7 months and peaked in March, 2024. The overall attack rate (AR) was 167/100,000 with males (AR=201/100,000) more affected than females (AR=132/100,000). The odds of infection were higher among persons who slept on the hides of animals (OR=11, 95% CI:2.6-47) and those who were involved in slaughter (OR=5.3,95%CI:1.8-15). There was a dose-response effect for persons who slaughtered, skinned and carried (OR=19, 95% CI:2.6-136), slaughtered and carried (OR=13,95%CI:2.2-78) and those who slaughtered and skinned (OR=8.1,95%CI:2.1-31). Out of 24 human samples, 7 tested positive for *Bacillus anthracis*. Scattered bones and abandoned animal skins were observed indicating possible widespread death of animals which points to existence of environmental anthrax spore in the soils.

**Conclusion:** This cutaneous anthrax outbreak, was linked to slaughtering cattle that died suddenly and sleeping on cattle hides. We recommended community education on anthrax, vaccination of animals against anthrax and safe animal carcass disposal practices.

**Keywords**: Anthrax, Cutaneous, Outbreak, Uganda

# Human anthrax outbreaks in Uganda during January 2017–October 2024: A descriptive analysis of surveillance data

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**Background**: The global incidence of anthrax, a zoonosis of outbreak potential caused by category A bioterrorism agent bacillus anthracic has reportedly declined. However, outbreaks continue to occur in Uganda and other countries. Outbreaks in Uganda are reported to the Ministry of Health through event-based surveillance, and the data is uploaded to the electronic Public Health Emergency Management (ePHEM) database. A single confirmed case of human anthrax constitutes an outbreak. We described the trends and geographical distribution of anthrax outbreaks in Uganda from January 2017 to October 2024 to inform prevention and control programming.

**Methods:** We abstracted data on anthrax outbreaks from the ePHEM from January 2017– October 2024. The data included; the number of cases, affected areas, situation reports, and investigation reports. Data on regions and districts affected was presented in frequencies and proportions. We determined trends in anthrax outbreaks using Sen's slope, and Mann-Kendall to test for significance of the trend. P-values <0.05 were considered statistically significant.

**Results:** Uganda experienced 37 anthrax outbreaks between 2017-2024, ranging from 2-12 annually, with the majority (37%) occurring in 2024. These resulted in 1,080 cases, including 125 (11.6%) confirmed cases. They resulted in 31 fatalities, and a total case fatality rate (CFR) of 2.9% (31/1,080). An increasing trend in anthrax outbreaks was noted from 2020 to 2024 (p=0.043). Anthrax outbreaks occurred in all four regions (i.e., northern, eastern, western, and central region) of the country, with the majority (37%, 12) occurring in the Bugisu sub-region in the eastern region, and the Ankole sub-region in the west (30%,11). Eighteen (12%) of the 146 districts in Uganda were affected. Kween (eastern region), Ibanda (western region), and Madi-Okollo (northern region) districts had reoccuring outbreaks. Anthrax outbreaks occurred in new areas in 2022 (Madi-Okollo and Ibanda in the northern and western regions, respectively); in 2023 (Kyotera, Lwengo, and Mubende in the central region), and in 2024 (Bukedea (eastern region), Amudat (northern region), and Kanungu, Bushenyi and Buhweju districts in the western region, with some of the new areas having the highest case fatality rates such as 25% (n=1) in Lwengo and Mubende (central region) and 17% (n=13) in Kyotera (central region) districts.

**Conclusion:** Results have demonstrated an increasing trend of anthrax outbreaks in Uganda, with some districts having recurrent outbreaks. Some of the new districts reported highest case fatality rates which presents a public health challenge. The anthrax control program should be strengthened, and targeted interventions are needed for districts experiencing recurrent outbreaks.

**Keywords:** Anthrax outbreaks, zoonosis.

# A descriptive analysis of deaths occurring within a population-based cohort between 2005 and 2021 in Eastern Uganda

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**Background:** Globally, nearly half of all deaths are not recorded and this tends to underestimate the burden of disease in the general population or particular sections of it. Using routinely updated data from the Iganga-Mayuge Health and Demographic Surveillance Site (IMHDSS), we explored the place of death and described characteristics of the deaths to guide interventions for health programming.

**Methods:** The cohort is from 65 villages in Iganga and Mayuge Districts located in Eastern Uganda. Data on all deaths that occurred between 2005 and 2021 within the IMHDSS were abstracted from the electronic database for inclusion in the study. Data on place of death (community or hospital); deceased's demographic characteristics (age at death and sex); assigned cause of death were abstracted. Descriptive statistics including counts and percentages were calculated, with bar graphs; pie charts. Mortality rates were calculated using the annual mid-year population sizes of the cohort for the study period. Annual mortality trends we presented as line graphs and tested for significance using Mann-Kendall analysis.

**Results:** A total of 8,036 deaths occurred in the 16-year period, of which, most deaths, 4424 (53%), occurred among males and 4867 (60%) occurred in the community. The overall mortality rate was 6.1/1,000, with an increasing trend by age group. Males had higher a mortality rate, 6.6/1,000 (t = 0.5147, p = 0.0055), than females, 5.6/1,000 (t = 0.3225, p = 0.0035). The age group ≥80 had the highest mortality rate of 100.2/1,000 population. Most deaths from communicable diseases were due to Malaria (42%), while for non-communicable diseases, most were cardiovascular (42%). As age at death increased, the proportion of community deaths increased from 55% in the <1-year-old to 90% in the ≥101 years old.

**Conclusion:** The highest mortality rates were among males, adults aged 80 years and over, occurred in the community and due to communicable diseases. Malaria, HIV/AIDS, Cardiovascular disorders and cancer were the leading causes of death. We recommend Ministry of Health programmes targeted to improving the health seeking behavior to reduce community deaths, mainly due to preventable communicable diseases.

**Keywords:** Population-based cohort, death

# Mortality trends due to vaccine-preventable diseases among children under 5 years from a population-based cohort in Eastern Uganda, 2008 to 2022

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**Background:** Uganda is among the Sub-Saharan countries with high under-five mortality (U5M) rates. Overtime, the U5M rates have reduced from 137 to 40/1000 live births from 2007 to 2022 which is still above 2030 Sustainable Development Goal (SDG) target of 25/1000 live births. Intervention such as routine vaccination is expected to reduce U5M rates. We assessed the mortality trends in vaccine-preventable diseases among U5 in eastern Uganda from a population-based demographic surveillance cohort from 2008 to 2022.

**Methods:** We conducted a descriptive analysis of U5 children who died and reported in surveillance data from the Iganga-Mayuge Health and Demographic Surveillance Site (IMHDSS) between 2008 to 2022. Demographic Surveillance system works by monitoring individuals, households and residential units in a well-defined geographic area. We calculated mortality proportions and rates by cause, age and sex. We analyzed data using STATA version 14. We used line graphs to show trends over time and conducted trend analysis using the Mann-Kendall test for trends.

**Results:** A total of 3,564 children <5 years died during the period 2008 to 2022. The average annual mortality rate was 31/1000 live birth. The mean age of the children was 5.6 months (Range 0  49, SD 0.13). The majority 1,926 (54%) had a verbal autopsy (VA), and most (37%) of the VAs were in children 0-11 months. A total of 244 (13%) of the children died due to vaccine-preventable diseases. Diarrheal diseases were the leading cause of death at 47% (115), pneumonia at 26% (64), meningitis at 17% (39) and measles at 10% (26) among the VPNs. There was a decreasing non-significant mortality trend among U5 due to vaccine-preventable diseases.

**Conclusion:** U5M due to vaccine-preventable diseases in Eastern Uganda has not decreased significantly over the years as expected. Diarrheal diseases were the leading cause of death among vaccine-preventable diseases. There is need to enhance strategies targeting combating vaccine-preventable diseases in Eastern Uganda.

**Key words:** Vaccine-preventable disease, Mortality, Trend

# Trends and spatial distribution of leading causes of mortality in Uganda, 2018–2023

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**Background**: Registration of mortality is a vital statistic for health planning, policy formulation and planning. The 2019 report from National Identification and Registration Authority reports that only 1% of all deaths in Uganda are notified and registered annually. We described the leading causes of mortality and their trends between 2018–2023 to inform implementation of specific interventions in regions

**Methods:** We analysed secondary data from the District Health Information System for 2018–2023 and Uganda Demographic and Health Survey, 2022. We abstracted mortality data on causes of mortality by age, sex and health facility. We calculated annual cause specific mortality rates per region per 100,000 population by dividing total deaths by total population of the region for 2018–2023 as per Uganda Bureau of Statistics. We established annual trends in distribution of cause specific mortality using a line graph and demonstrated its significance using the Mann Kendall test.

**Results:** A total of 290,325 deaths were registered in DHIS2 with a crude death rate of 6.5/1000 between 2018–2023. Of all the total deaths, 10%(28,000) were caused by Malaria which was the leading cause of mortality followed by neonatal conditions with 8%(23,871). Malaria incidence increased from 358/100,000 in 2018 to 388/100,000 in 2023 (p=0.08). There was a significant increase in all-cause mortality rate in Lango Region from 43/100,000 in 2018 to 55/100,000 in 2023 (p=0.02). Kampala Region consistently registered high all-cause mortality rates across the six years compared to regions like Teso and Bukedi. In 2018 Kampala Region registered mortality rates of 3.5%(641/100,000) and 4%(712/100,000) in 2023.

**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 Lango 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.

**Key words:** Under-5 mortality, vital statistics, all-cause mortality, cause specific mortality

# Perinatal deaths in Kampala Metropolitan Area (KMA): A descriptive analysis of trends of perinatal deaths during 2020-2023

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**Background**: Uganda's perinatal death (PD) rate was 17.8/1,000 births in 2022/2023, higher than Every Newborn Action Plan and SDG 3 target of ≤12 per 1,000 births by 2030. To reduce the burden, Uganda is implementing the maternal and perinatal death surveillance and response (MPDSR) in health facilities. We assessed the PD rate in KMA during 2020-2023 and identified delays contributing to PDs in Kampala City.

**Method**: We abstracted quarterly PD and total births data for KMA, i.e., Kampala, Wakiso, Mukono and Mpigi districts from the District Health Information System (DHIS2) for the period 2020–2023. Data on delays were available from the PD audits that are carried out by health facilities using the MPDSR tool and uploaded into the DHIS2. PDs were calculated as a sum of macerated stillbirths (MSB), fresh stillbirths (FSB) and early neonatal deaths (END) reported in DHIS2 by health facilities. PD rate was calculated as number of PDs per 1,000 births and stratified the rate by district and Kampala city divisions. Descriptive statistics and trend analysis were used to summarize changes in PD overall and at district level. We assessed the significance of PD rate trends using the Mann-Kendall test. We analyzed the Kampala audits results to identify delays contributing to PD.

**Results**: Overall, KMA recorded 17,184 PDs during 2020–2023: 13,008 (75.7%) from Kampala, 2,498 (14.5%) for Wakiso, 1,154 (6.7%) for Mukono, and 524 (3.1%) for Mpigi. The average annual PD rate in KMA was 17/1,000 births, declining from 18.2/1,000 births (2020) to 15.8/1,000 births (2023) (p=0.0078). The average PD rate was highest in Kampala: (29.2/1,000 births) and lower in Mpigi (12.7/1,000 births), Mukono (12.2/1,000 births), and Wakiso (12.1/1,000 births) districts. In Kampala, Kawempe (85.9/1,000 births) and Nakawa (31.5/1,000 births) divisions had the highest average PD rates. The most common contributing factors for PDs in Kampala city were delays in seeking healthcare (28%, n=10,192) and delays in reaching the health facility (23%, n=10,192).

**Conclusion:** The reduction in PD rate shows positive progress towards prevention of perinatal deaths in KMA particularly in Mpigi, Mukono and Wakiso where the target has almost been achieved. However, more efforts are needed to reduce the burden in Kampala city where the burden is still two-fold higher compared to the target of 12/1,000 births. Continuous education of mothers on timely seeking of care will be needed to save the lives of babies.

**Keywords:** Perinatal death, Still births, Asphyxia