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Dear Reader,

We take great pleasure in welcoming you to Issue 3 Volume 9 of the Uganda Public Health Bulletin.

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

In this issue, we present a variety of articles including: Assessment of emergency medical services in Uganda, trends and distribution of malaria in pregnancy in Uganda, trends and distribution of maternal sepsis in Uganda, improvement of sample receipt turn around time for HIV viral load using a continuous quality improvement approach in Kigezi region, cholera outbreak at Kasensero landing site, Kyotera District, measles outbreak in children below the recommended age for the first dose of measles vaccine most affected, Kakumiro District, measles outbreak, Terego District, and anthrax outbreak associated with sleeping on hides of animals that dies suddenly in Amudat District.

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We hope you find this information valuable.

Thank you

Inside this issue:

Assessment of Emergency Medical Services, Uganda, 2020–2023

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Summary
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. EMS play a crucial role in reducing morbidity and mortality associated with time-sensitive emergencies. In 2021, the Uganda Ministry of Health (MoH) launched the EMS policy and strategic plan to improve the quality and accessibility of EMS. It is not clear how EMS has changed since then. We analyzed EMS data from District Health Information System 2 (DHIS2) to assess trends of selected EMS indicators, Uganda, 2020–2023.

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

Results: Between 2020–2023, Uganda registered an annual average number of 254,258 patients involved in emergencies, with an average incidence of 290 emergencies/100,000 population. 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%) patients involved in emergencies developed complications within 24 hours while 45,766(18%) died. Of the deaths at emergency unit, 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 176/100,000 in January-June 2020 to 385/100,000 in June-December 2023 (p=0.004). There was an 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 EMS 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. We recommend expanding community-based first responder programs, enhancing EMS personnel training, and improving ambulance availability and coordination.

Background

Emergency Medical Services (EMS) encompass critical life-saving medical care provided at the scene, during transportation, and in emergency units at healthcare facilities. It is characterized by rapid assessment, timely intervention, and efficient transportation to appropriate health facilities. It significantly impacts outcomes for patients with time-sensitive conditions such as communicable infections, non-communicable diseases, obstetric emergencies, and trauma (1–3).

The communicable infections requiring EMS may include sepsis, meningitis, severe pneumonia, severe malaria, and Ebola virus disease among others. Non-communicable diseases needing urgent care may include acute myocardial infarction, stroke, diabetic ketoacidosis, acute asthma attack, and pulmonary embolism. Obstetric emergencies may include conditions such as eclampsia, placental abruption, postpartum hemorrhage, uterine rupture and pre-eclampsia. Additionally, trauma conditions like traumatic brain injury, spinal cord injury, severe burns, major fractures, and penetrating injuries require prompt medical intervention to prevent significant morbidity and mortality.

In Uganda, maternal mortality was estimated at 336 deaths per 100,000 live birth in 2020 while road traffic crushes caused approximately 4,197 on site deaths in 2023(4,5).These conditions contribute significantly to the country's morbidity, disability and mortality rates. Effective EMS can play a crucial role in reducing some of these avoidable morbidity, disability or mortality.(6,7).

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Recognizing the importance of strengthening emergency care, the Ugandan Ministry of Health (MoH) formulated the EMS policy in 2021 to address existing challenges in responding to emergencies, laying the foundation for the development of a comprehensive EMS strategic plan encompassing protocols, guidelines, and standards aimed at improving the quality and accessibility of EMS across the country (8,9).

One of the primary objectives of the EMS strategic plan is to enhance the availability of quality EMS hospital care, particularly in 19 referral hospitals, 180 district hospitals, and 250 selected health center IVs by the year 2025, entailing the establishment of emergency departments/units, the development of a professional EMS workforce, and the creation of crisis centers within emergency departments across all regions of Uganda (10). It was also targeted to increase the proportion of patients involved in emergencies accessing on-scene emergency medical care to at least 50% and those receiving ambulance response within 1 hour to at least 50% by 2025.

To monitor progress and performance, the EMS strategic plan integrated key performance indicators into the District Health Information System 2 (DHIS2), a web based comprehensive Health Information Management System (HMIS) widely utilized by the MoH. These indicators provide insights into various aspects of EMS, including response times, patient outcomes, and resource utilization (10). We analyzed EMS data from District Health Information System 2 (DHIS2) to assess trends of selected EMS indicators, Uganda, 2020–2023.

Methods

Study design, data source, and study variables

We conducted a descriptive analysis of EMS surveillance data collected from the entire country using the DHIS2. These data are reported by all emergency units/departments managing patients involved in emergencies in Uganda. We abstracted six-monthly (2020–2023) data on key EMS indicators from DHIS2. These indicators included number of patients involved in emergencies at facilities, number of patients involved in emergencies that received care at the scene of the emergency, those that arrived at the health facility in an ambulance, those assessed for level of consciousness, those accessing emergency services within one hour in an emergency unit, and those who developed complications within 24 hours after management/care. We also abstracted data on deaths at emergency units and the different causes of deaths that included medical causes, surgical causes, obstetric and gynecological causes, road traffic injuries, burns, and poisoning. We abstracted data at national and regional levels and downloaded it into Microsoft excel and cleaned it.

Data analysis

We determined the incidence of emergencies per 100,000 population using the national and regional mid and end year population estimates from 2020–2023 from Uganda Bureau of Statistics (UBOS) (11). We determined the proportions of patients involved in emergencies assessed for level of consciousness, accessing emergency services with one hour in an emergency unit, who developed complications within 24 hours after management/care and who died at the emergency unit. We determined the proportion of the total deaths at emergency units cause by different conditions. We determined the significance of the semi-annual trends by conducting Mann-Kendall test using Stata version 14. We demonstrated the regional performance using Quantum Geographic Information System (QGIS) maps.

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Ethical considerations

This study used EMS surveillance data reported by health facilities in the DHIS2 which were also aggregated with no individual patient identifiers. However, we obtained administrative clearance to use the data from the Uganda MoH. The US Centers for Disease Control and Prevention (CDC) also determined that this activity was not human subject research and its primary intent was for public health practice or disease control. This activity was reviewed by CDC and was conducted consistent with applicable federal law and CDC policy. §§See e.g., 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

Results

Annual incidence of patients involved in emergencies at health facilities, Uganda, 2020–2023

The incidence of patients involved in emergencies as reported by healthcare facilities increased from 176 patients/100,000 in January-June 2020 to 385 patients/100,000 in July-December 2023 (Table 1).

Table 1: Annual total number and incidence of patients involved in emergencies at health facilities, Uganda, 2020–2023

	Total number of patients involved in emergencies	Population	Incidence of patients involved in emergencies/100,000
Jan-Jun 2020	73,053	41,583,600	176
Jul-Dec 2020	104,510	42,368,800	247
Jan-Jun 2021	116,170	42,885,900	271
Jul-Dec 2021	107,632	43,716,700	246
Jan-Jun 2022	133,131	44,212,800	301
Jul-Dec 2022	141,344	45,097,400	313
Jan-Jun 2023	156,551	45,562,000	344
Jul-Dec 2023	179,037	46,508,200	385

National trend of incidence of patients involved in emergencies, Uganda, 2020–2023

The incidence of patients involved in emergencies increased significantly from 176 patients /100,000 population in January–June 2020 to 385 patients/100,000 in July–December 2023 (p-value = 0.004). During this period, the reporting rate was 100% (Figure 1).

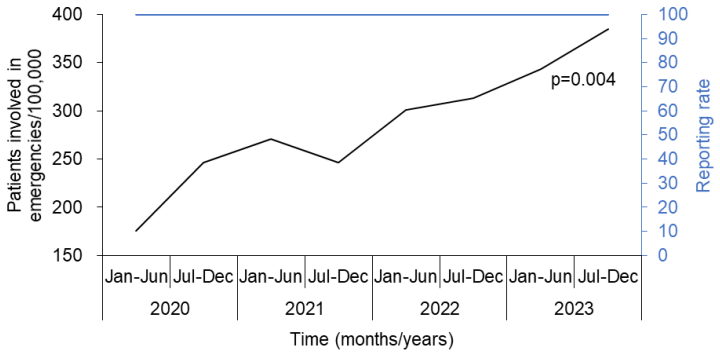

Figure 1: Semi-annual trend of incidence of patients involved in emergencies and reporting rates. Uganda, 2020–2023

Trends of ambulance use and receiving care at the emergency scene among patients involved in emergencies, Uganda, 2020–2023

The proportion of patients involved in emergencies who arrived at the health facility in an ambulance stagnated at around 9% (p-value = 0.3) and was below the 50% target throughout the study period. The proportion of patients involved in emergencies who received care at the scene of emergency stagnated between 64-55% (p-value = 0.06) throughout the study period, but was generally above the 50% target (Figure 2).

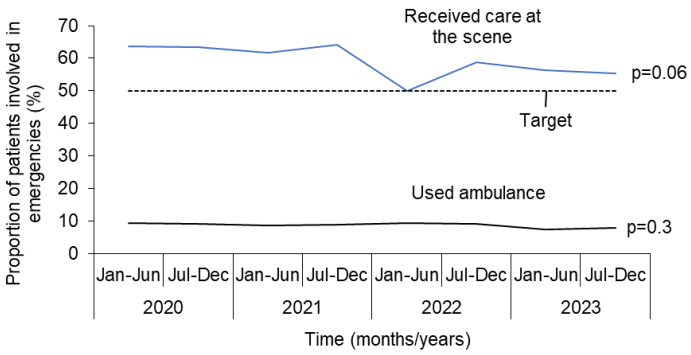

Figure 2: Semi-annual trends of ambulance use and receiving care at the emergency scene among patients involved in emergencies, Uganda, 2020–2023

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Trends of assessment of level of consciousness and receiving care within one hour at the emergency unit among patients involved in emergencies, Uganda, 2020–2023

The proportion of patients involved in emergencies assessed for level of consciousness reduced from 47% in January-June 2020 to 29% in July-December 2020 and then increased significantly to 50% in June-December 2023 (p-value = 0.04). However, this was way below the 100% target. The proportion of total emergency patient who received emergency care within one hour in an emergency unit increased slightly from 69% in January-June 2020 to 81% in June-December 2023. However, this increase was nonsignificant (p-value = 0.2) (Figure 3).

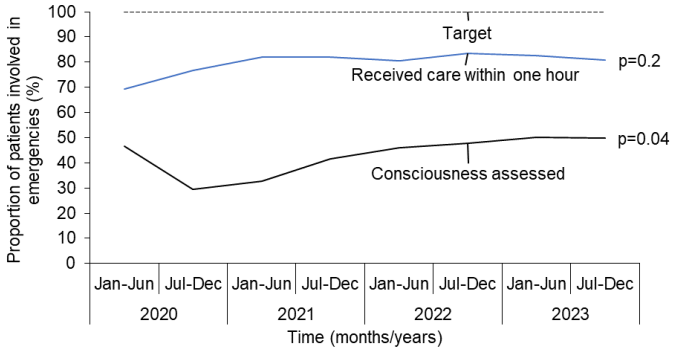

Figure 3: Trends of assessment of consciousness and receiving care within one hour at the emergency unit among patients involved in emergencies, Uganda, 2020–2023

Trends of complications and mortality among patients involved in emergencies, Uganda, 2020–2023

The proportion of patients involved in emergencies who developed complications within 24 hours after management stagnated between 1.9 -1.7% throughout the study period (p-value = 0.7). However, the proportion of patients involved in emergencies who died at the emergency unit decreased significantly from 27% in January-June 2020 to 8% in June-December 2023) (p-value = 0.004) (Figure 4).

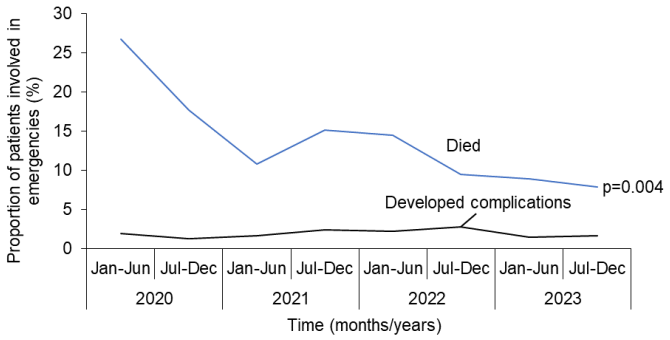

Figure 4: Trends of complications and mortality at emergency unit among patients involved in emergencies, Uganda, 2020–2023

Causes of death among patients involved in emergencies Uganda, 2020–2023

From 2020–2023, medical emergencies were increasingly the leading cause of death at emergency units (37-48% deaths), followed by road traffic injuries (25-20% deaths) (Table 2).

Table 2: Different causes of death at emergency departments, Uganda, 2020–2023

Cause of death	2020	(%)	2021	(%)	2022	(%)	2023	(%)
Medical emergencies	14,031	(37)	11,061	(38)	13,171	(40)	13,535	(48)
Road traffic Injuries	9,397	(25)	7,199	(25)	6,564	(20)	5,682	(20)
Pediatric emergencies	3,432	(9)	2,570	(9)	4,624	(14)	2,368	(8)
Surgical emergencies	3,369	(9)	2,933	(10)	3,489	(11)	2,662	(9)
Burns	3,237	(8)	2,297	(8)	1,958	(6)	1,612	(6)
Obstetrics/gynecology emergencies	2,705	(7)	1,688	(6)	1,822	(6)	1,433	(5)
Poisoning	1,915	(5)	1,158	(4)	1,082	(3)	763	(3)
Total	**38,086**	**(100)**	**28,906**	**(100)**	**32,710**	**(100)**	**28,055**	**(100)**

Spatial trends and distribution of emergencies, Uganda, 2020–2023

The incidence of patients involved in emergencies generally increased in all regions throughout the study period, with the highest incidence noted in Kampala Region (2,000-3,000/100,000) followed Acholi and West Nile regions (1,000-1,999/100,000) (Figure 5).

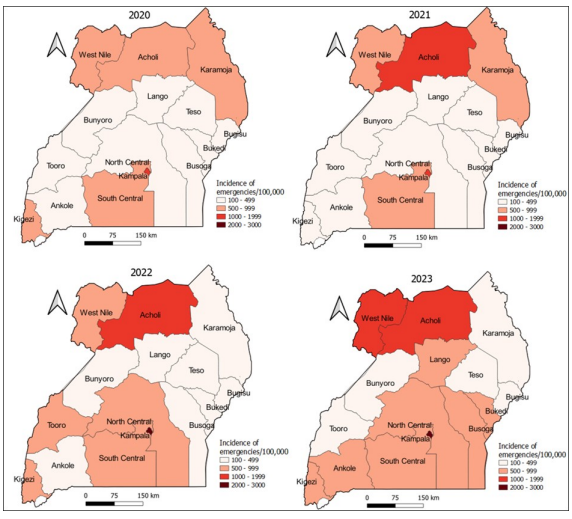

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Figure 5: Regional trends of incidence of patients involved in emergencies, Uganda, 2020–2023

Spatial trends and distribution of mortality among patients involved in emergencies at emergency departments, Uganda, 2020–2023

The mortality among patients involved in emergencies generally reduced in all regions throughout the study period (Figure 6).

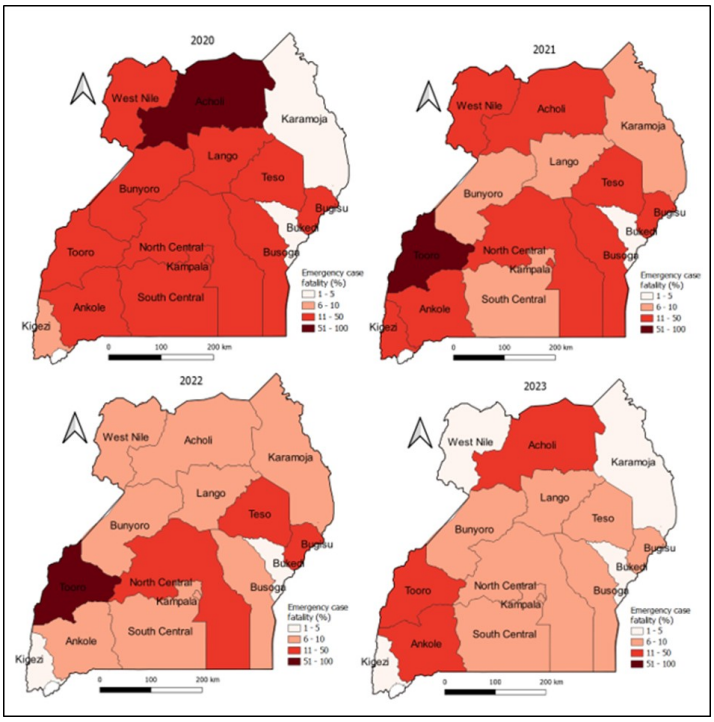

Figure 6: Regional trends of mortality among patients involved in emergencies in Uganda, 2020–2023

Discussion

The analysis of EMS performance using Uganda's DHIS2 from 2020–2023 revealed both encouraging progress and persistent challenges. We found a significant increase in the total number and overall incidence of emergencies across all regions, with Kampala Region exhibiting the highest incidence. The observed increase in the overall incidence of emergencies aligns with global trends reflecting growing healthcare needs and changing disease patterns (12,13). This trend is consistent with studies in low and middle-income countries where rapid urbanization and demographic shifts contribute to rising emergency healthcare demands (6). Furthermore, the regional disparities in emergency incidence, with urban centers like Kampala experiencing higher rates, resonate with previous research indicating higher healthcare utilization in densely populated areas (14).

There was a significant decrease in the proportion of patients who died at the emergency unit. This notable reduction in mortality among patients involved in emergencies across all regions suggests improvements in the quality of emergency care delivery. This finding is in line with studies emphasizing the importance of timely interventions, standardized protocols, and enhanced healthcare infrastructure in reducing mortality rates (15,16). The decline in mortality despite increasing emergency incidence underscores the effectiveness of interventions aimed at enhancing emergency care accessibility and quality nationwide.

While mortality rates decreased, certain EMS performance indicators exhibited mixed results. Despite the proportion of patients involved in emergencies accessing on-scene emergency medical care being above the 2025 target of 50%, the declining trend from 64% to 55% highlight persistent challenges in pre-hospital care. Additionally, the proportion of patients requiring emergency services who used ambulance services was way below the 2025 target of 50%. Similar findings have been reported in studies from resource-constrained settings, emphasizing the need for targeted interventions to improve pre-hospital care infrastructure and raise public awareness regarding EMS utilization (7,17).The modest improvement in the proportion of patients accessing emergency services within one-hour underscores ongoing challenges in ensuring timely care delivery. Studies have emphasized the critical importance of prompt access to care in improving patient outcomes, particularly in time-sensitive conditions such as trauma and acute illnesses (7). Addressing infrastructural limitations and strengthening referral systems could potentially mitigate delays in accessing emergency services, thereby improving patient outcomes.

Medical emergencies were consistently and increasingly the leading cause of death among patients involved in emergencies. These medical emergencies mainly include non-communicable diseases like acute myocardial infarction, stroke, diabetic emergencies, acute asthma attack, and pulmonary embolism among others. The shift towards medical emergencies as the leading cause of death underscores the evolving disease burden and the need for comprehensive emergency care beyond trauma-related conditions. This finding aligns with global epidemiological shifts towards non-communicable diseases and chronic conditions, highlighting the importance of adapting EMS systems to address diverse healthcare needs (18).

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Conclusion

The significant increase in the total number and incidence of emergencies underscores the growing healthcare needs and changing disease patterns within the country, emphasizing the importance of adapting EMS systems to meet evolving healthcare demands. The remarkable reduction in mortality rates among patients involved in emergencies across all regions reflects improvements in the quality of emergency care delivery, highlighting the effectiveness of interventions aimed at enhancing accessibility and standardizing care protocols. However, challenges persist in certain EMS performance indicators, such as the decline in patients receiving care at the scene and the stagnation in ambulance utilization. Additionally, the shift towards medical emergencies as the leading cause of death underscores the need for comprehensive emergency care beyond trauma-related conditions.

Study limitations

While our study provides valuable insights into the performance of EMS in Uganda, several limitations should be considered when interpreting the results.

Firstly, analysis relied on data abstracted from the DHIS2 where the accuracy and completeness of the data depend on the quality of reporting by healthcare facilities. Variability in reporting practices, missing data points, incomplete records and data entry errors could bias our analysis and limit the comprehensiveness and reliability of our findings.

Secondly, we were not able to comprehensively assess the in-hospital emergency care because some key indicators like number of patients with hypoxia who received oxygen and number of patients with hemorrhage controlled lacked denominators.

Additionally, the study focused on key EMS indicators available in DHIS2, but other important independent variables, such as pre-hospital care practices, ambulance fleet capacity, and healthcare provider training levels, were not assessed. The absence of these variables may limit the comprehensiveness of the assessment of EMS performance.

Recommendations

Based on the findings and limitations of our study, the following recommendations are proposed to enhance the effectiveness and efficiency of EMS in Uganda.

The MoH needs to improve the EMS data quality and completeness of reporting through regular training, capacity building, and monitoring.

The MoH needs to address the challenge of ambulance inaccessibility. This could involve expanding ambulance fleets, optimizing ambulance deployment strategies, and raising public awareness about the availability of ambulance services.

The MoH needs to invest in infrastructure, human resources, and logistical support to reduce response times and ensure timely access to emergency care.

The MoH needs to promote the adoption of standardized clinical assessment protocols, such as the Glasgow Coma Scale (GCS), to ensure consistent and accurate evaluation of patients' level of consciousness. Provide training and resources to healthcare providers to enhance their proficiency in conducting clinical assessments in emergency settings is essential.

The MoH needs to tailor EMS investments according to regional needs. For example, Kampala region that reported highest incidence of emergencies throughout the study period deserves the highest EMS investment.

The MoH could consider capturing data on number of patients involved in emergencies with hypoxia and number of patients involved in emergencies with hemorrhage so as to provide an appropriate denominator for oxygen use and hemorrhage control.

Conflict of interest

The authors declare that they have no conflict of interest.

Authors' contributions

AK participated in the conception, design, analysis, interpretation of the study and wrote the draft bulletin. BK, RM, EJN, JK, IM reviewed the report and the drafts of the bulletin for intellectual content and made multiple edits to the draft bulletin; BK and ARA reviewed the final bulletin to ensure intellectual content and scientific integrity. All authors read and approved the final bulletin.

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Acknowledgement

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

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Summary

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 MiP surveillance data generated from the entire country in the District Health Information System (DHIS2), 2015–2023. MiP was defined as laboratory-confirmed malaria in a pregnant mother. MIP was computed as a proportion of pregnant women with malaria who attended ANC1. Mann-Kendall test was used to evaluate the significance of linear trends.
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). Among the 15 regions of Uganda, Busoga (p=0.001), Teso (p=0.029), and West Nile (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 younger mothers at Health Centre 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.

Background

Malaria remains a disease of public health importance and has been on the global agenda for decades. Malaria infection carries serious risks for pregnant women, their fetuses, and their newborn babies. Pregnant women are at higher risk of malaria-related complications and death than age-matched women who are not pregnant (1,2). Infection of malaria during pregnancy is associated with an increased risk of fetus low birthweight, stillbirth, pre-term deliveries, miscarriages, maternal anemia, and sometimes maternal death; women in their first and second pregnancies are particularly vulnerable and decrement in intrauterine fetal growth (3,4).

The World Health Organization (WHO) estimated a global prevalence of 241 million cases in 2020 where sub-Saharan Africa took the top spot with more than 95 % of the worldwide burden (5). Similarly, there were an estimated 445,000 malaria deaths worldwide with 91% of the deaths occurring in the Africa region (6). The World Malaria Report, released in December 2021, reflects the global malaria community's unique challenges. The report showed the devastating toll of malaria, with an estimated 627,000 people losing their lives to the disease in 2020 (7). In 2019, an estimated 11.6 million pregnancies were exposed to malaria in sub-Saharan Africa (SSA) which led to an estimated 822, 000 malaria in pregnancy (MiP)-related LBW babies and more than 40% of maternal anemia cases due to malaria occurring in these countries (7).

Malaria prevalence among pregnant women ranges from 13.1 to 50.0% but can be as high as 80% in highly endemic regions (8,9). The prevalence of MiP from population-based studies in Uganda ranges from 8.9% in the country's low transmission areas to over 50% in high transmission settings (8–10). In Uganda, the overall burden of malaria is high and its adverse outcomes to the infected mother and the unborn child are widespread. In 2019, 152 of the total 3,528 maternal and newborn deaths in Uganda were due to MiP (9).

Risk factors associated with MiP include infection with human immunodeficiency virus (HIV), poor housing, low level of maternal education, and non-adherence to malaria preventive measures like insecticide-treated bed nets and IPTp (9,11–14). Uganda has embarked on several interventions

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aimed at the prevention and reduction of morbidity and mortality due to MiP such as: having at least 60% of all pregnant women receive ≥2 doses of sulfadoxine-pyrimethamine (SP) as Intermittent Preventive Treatment during pregnancy (IPTp) in their second and third trimesters; at least 80% of pregnant women accessing quality case management; and at least 60% using Insecticide-treated bed nets (ITNs) (15). Use of ITNs has been reported to underlie a 23% reduction in placental parasitemia while ≥ 3 doses of IPTp-SP has been associated with up to 56% reduction in the risk of peripheral parasitemia and a significant decrease in sub-microscopic infections (16,17).
Despite the interventions, there has been a considerable increase in malaria transmission in Uganda, especially during the study period but it remains unclear how this has impacted the burden of MiP (18,19). Data analysis is important to help evaluate, directly or indirectly, the effectiveness of many years of targeted preventive interventions including IPTp-SP and ITNs. Identifying where greater burdens persist for intensifying control interventionsis useful. We examined trends and spatial distribution of malaria in pregnant women attending antenatal care in Uganda, 2015 –2023.

Methods

Study setting

Malaria prevention and treatment services are integrated into routine antenatal care visits. MiP services are offered at various levels of healthcare facilities in Uganda, including primary health centers which are the first point of contact for most mothers and provide basic MiP services, district hospitals which offer more specialized care and serve as referral centers for primary health centers, and regional referral hospitals that provide advanced care and handle complex cases. The healthcare facilities are either government-owned where free MiP services are offered or privately owned where mothers pay a fee to access services. The country is divided into 15 non-administrative sub-regions comprising nine to thirteen districts considered the malaria endemicity zones under the Uganda Demographic and Health Survey program by 2018. The risk of malaria transmission in Uganda varies geographically, from less than 1% malaria prevalence in Southwest Uganda) to greater than 20% in Busoga, Northwest, and 34% in Northeast Uganda (20).

Study design and data source

We conducted a descriptive study using routinely collected MiP surveillance data in DHIS2. DHIS2 collects data on diseases of public health importance such as malaria based on the Integrated Disease Surveillance and Response guidelines (MoH 2021). It includes data on laboratory-confirmed cases due to MiP. In this study, we utilized aggregate data on MiP from monthly outpatient reports (Health Management Information System forms [HMIS] 105) 2015–2023.

Study variables, data distribution, and analysis

We extracted data on annual first antenatal visits and annual antenatal clinic malaria in pregnancy cases. In addition, we extracted data on HMIS 105 reporting rates. Malaria in Pregnancy (MIP) was computed as the proportion of pregnant women attending ANC1 who tested positive for malaria. We analyzed MiP incidence by examining the trends across several stratifying factors: geographic region, health facility level, facility ownership, and age of the pregnant women. For the age group variable, we considered data for 2020–2023 given that from 2015 -2019, this variable was aggregated as <5 and >5 years which could not give meaningful analysis results. The age group variable was analyzed quarterly for the period 2020-2023 with the following age categories: 10-19 years and 20+ years. We used line graphs to demonstrate the trends and the Mann-Kendall test to determine the statistical significance of the trends. Data was analyzed using STATA version 17. Choropleth maps for MiP for the period from 2015 to 2023 were generated using Quantum Geographic Information System (QGIS) to indicate the distribution of MiP in Uganda.

Ethical considerations

Our study utilized routinely aggregated surveillance data with no personal identifiers in health facility outpatient and in-patient monthly reports, obtained from the DHIS-2. The Uganda Public Health Fellowship Program is part of the National Rapid Response Team and has been granted permission to access and analyze surveillance data in the DHIS-2 and other data such as survey and field investigation data to inform decision-making in the control and prevention of outbreaks and public health programming. Additionally, the Ministry of Health (MoH) has also granted the Program permission to disseminate the information through scientific publications. We stored the abstracted dataset in a password-protected computer and only shared it with the investigation team. In addition, the Office of the Associate Director for Science, U.S. 144 Centers for Disease Control and Prevention, determined that this study was not a human subjects research with the

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primary intent of improving the use of surveillance data to guide public health planning and practice. This activity was reviewed by the CDC and was conducted consistent with applicable federal law and CDC policy. § 149 §See e.g., 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

Results

Trends in Malaria in Pregnancy among women attending antenatal care, Uganda, 2015–2023

Overall, 2,808,426 MiP cases were reported for the nine years reviewed. The incidence of MiP as a proportion of pregnant women attending antenatal care increased from 154/1,000 in 2015 to 205/1,000 in 2023(p=0.02). The highest incidence was in 2022 (218/1,000). The reporting rates were between 80% and 98% throughout the study period (Figure 1).

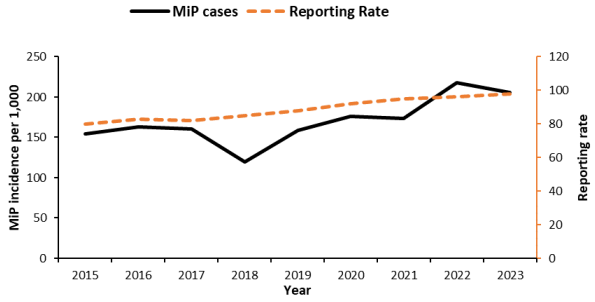

Figure 1: Trends in Malaria in Pregnancy among pregnant women attending antenatal care, and reporting rates, Uganda, 2015–2023

Trends of Malaria in Pregnancy among pregnant women attending antenatal care by health region, Uganda, 2015–2023

At the regional level, Busoga, West Nile, and Teso had a significantly increasing trend of MiP. However, the Karamoja region had a decreasing trend (Table 1).

Table 1: Trends of Malaria in Pregnancy among pregnant women attending antenatal care by Health Region, Uganda, 2015–2023

Region	Kendall's score	p-value
Busoga	32	0.0012
West Nile	25	0.012
Bunyoro	23	0.76
Teso	22	0.029
Lango	18	0.076
North Central	14	0.18
Bukedi	8	0.47
Acholi	4	0.76
Bugisu	2	0.92
Kampala	-3	0.83
Tooro	-6	0.60
Ankole	-8	0.47
Kigezi	-10	0.34
South Central	-10	0.34
Karamoja	-19	0.0059

Trends of Malaria in Pregnancy among pregnant women attending antenatal care by age group, Uganda, 2015-2023

There was an increasing trend in the incidence of MiP in all age groups of pregnant women attending antenatal carei.e. 10-19 years (Kendall's score=56, p=0.013) and those that were ≥20 years (Kendall's score=54, p=0.017) (Figure 2).

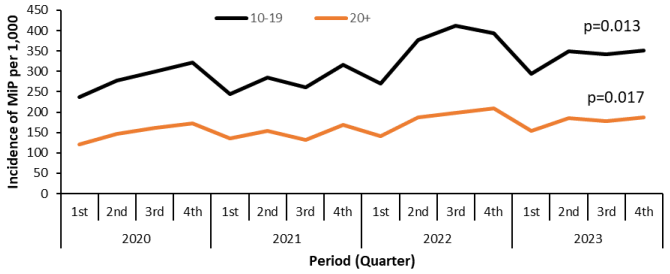

Figure 2: Trends of Malaria in Pregnancy among pregnant women attending antenatal care by age group, Uganda, 2015–2023

Trends of Malaria in Pregnancy among pregnant women attending antenatal ca by health facility level, Uganda, 2015–2023

The proportion of MiP increased significantly in Health Centre III (HCIII) (p=0.02, Mk=22), while in the Regional Referral Hospitals (RRH), the proportion of MiP reduced significantly (p=0.03, Mk=-21). Among the other health facility levels (General hospitals, Health Centre IV, Health Centre II, and clinics), MiP proportions did not significantly change over the study period (Figure 3).

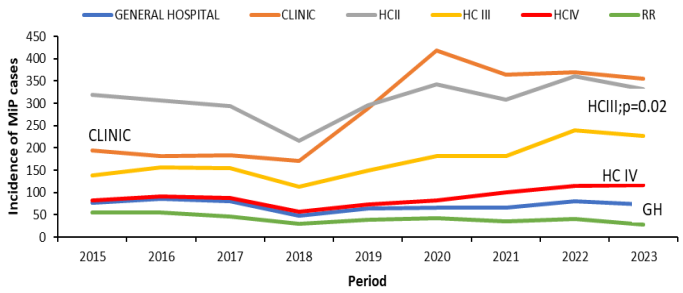

Figure 3: Trends in Malaria in Pregnancy among women attending antenatal care by health facility level, Uganda, 2015–2023

Trends of Malaria in Pregnancy among women attending antenatal care by Health Facility Ownership, Uganda, 2015–2023

The proportion of MiP significantly increased in government health facilities. In these facilities, the incidence of MiP increased from 147 cases

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per 1,000 pregnant women in 2015 to 207 cases per 1,000 pregnant women in 2023 (Figure 4).

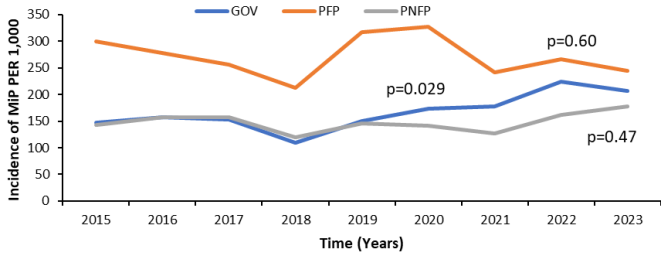

Figure 4: Trends of Malaria in Pregnancy among pregnant women attending antenatal care by Health Facility Ownership in Uganda, 2015–2023

Spatial distribution of Malaria in Pregnancy among pregnant women attending antenatal care by health region, 2015–2023

There was an overall increase in MiP as a proportion of all pregnant women attending antenatal care. Increasing trends in MiP were observed in Busoga, West Nile, and Teso regions while decreasing trends were evident for the Karamoja region (Figure 5).

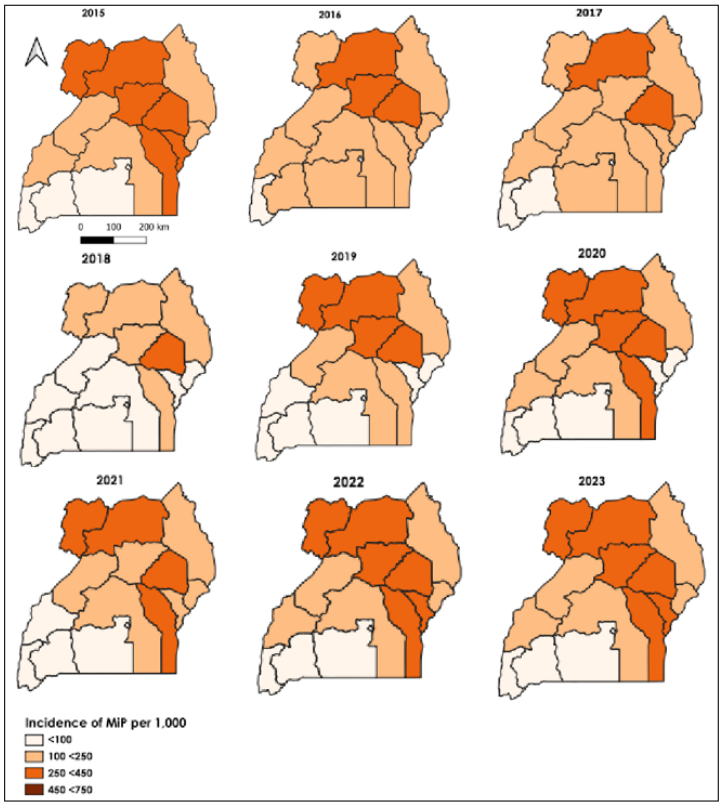

Figure 5: Spatial distribution of Malaria in Pregnancy among pregnant women attending antenatal care by region, Uganda, 2015–2023

Discussion

We highlight an overall increase in the proportion of MiP among pregnant women attending antenatal care over the nine years nationally and for some of the regions. There was a significant decline in the trend of MiP in the Karamoja region. An increasing trend was also observed in all age categories of pregnant mothers with women within the age category of 10-19 years having a higher incidence of MiP than those who were ≥20 years. Looking at health facility type, only Health Centre III's had an increasing trend while Regional Referral Hospitals depicted a decreasing trend. Public health facilities reported a significant increase in MiP during the study period.

The apparent increase in MiP incidence mirrors reported increases in the overall malaria burden in Uganda during the study period, a trend observed in other malaria high-burden countries (19). The notable increase from 2021 to 2022 in MiP cases reflected the rebound malaria epidemic, probably explained by the waning effects of the ITNs from the 2020 mass campaign. In addition, ITN distribution during the ANC1 visit was below 50% much less than the Uganda Malaria Reduction and Elimination Strategic Plan (UMRESP) (21).

The proportion of young pregnant women <20 years with MiP who could be primigravidae was significantly higher than those that were ≥20 years. Current evidence shows that the risk of malaria is higher in the primigravidae in younger pregnant women, and infections tend to peak early and decline towards term, reflecting the gradual acquisition of malaria immunity (11,12). In a Malawian study, adolescent pregnant women (age<20) were more likely to suffer from malaria than older women, and the risk was highest in the early trimester (23). Additionally, younger mothers have naïve pregnancy experience with limited knowledge and access to antenatal care where they would benefit from preventive interventions.

Health Center III's and other lower-level facilities were found to have a significant increase in the trend of MiP incidence among other health facility levels. These findings are not surprising given that lower-level facilities are the first point of care for the mothers where they seek services for uncomplicated malaria (24). Equipping low-level health facilities with adequate malaria commodities for the management of MiP could help improve access to them.

Our findings revealed an increase in the trend of MiP in government health facilities unlike private-for-profit and private-not-for-profit health facilities. A

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study conducted on patient perspectives on interpersonal aspects of healthcare and patient-centeredness at primary health facilities revealed that patients using public facilities utilized them because of their proximity and the absence of fees charged at the time and point of use (24). A higher burden of disease has been noted among the poor with less access to healthcare services, this could explain the higher increase in the proportion of MiP in public health facilities that offer free medical services(24). Equipping public health facilities with adequate quantities of MiP management supplies is critical in ensuring the proper management of patients and reduced severity of MiP.

Study limitations

Our study has some limitations that should be considered when interpreting the results. We used secondary data from the District Health Information System 2 (DHIS2), which has challenges of completeness and accuracy, likely leading to either over or underestimation of MiP among pregnant women.

Conclusion

Uganda registered a significant increase in malaria in pregnancy incidence from 2015–2023 suggesting higher risks of malaria-related complications during pregnancy. The burden of MiP was much higher among younger mothers suggesting targeted interventions to this more vulnerable age group. MiP also increased at Health Centre III and public health facilities. Further investigation into the reasons for the increasing incidence of malaria in pregnancy in regions of Busoga, Teso, and West Nile could provide insights for programming to reduce the burden.

Conflict of interest

The authors declare that they have no conflict of interest

Author's contribution

CM conceptualized the idea, analyzed and interpreted the data, and drafted the manuscript; RM, BK, LB, DK, GR, JN, MK, and ARA reviewed the bulletin for intellectual content.

Acknowledgments

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Trends and Distribution of Maternal Sepsis, Uganda, 2018-2022

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Summary

Background: Maternal sepsis (MS) is a pregnancy-related life-threatening condition that occurs after infection during pregnancy, childbirth, after delivery, or after an abortion. In low-income countries, MS causes 10% of preventable maternal deaths. In 2016, MS caused 13% of maternal deaths in Uganda. In 2019, the Ministry of Health set a target of reducing the proportion of sepsis-attributable maternal deaths to 8% by 2024. We assessed the trends and distribution of maternal sepsis incidence, maternal deaths attributable to sepsis, and maternal sepsis case-fatality rate, Uganda, 2018-2022, to inform programming.
Methods: We calculated MS cases per 10,000 live births per year from 2018–2022 at district, regional, and national levels, using the District Health Information System version 2 (DHIS2) data, 2018–2022. We also calculated MS deaths per 100 maternal deaths, and MS deaths per 100 MS cases. The Mann-Kendall test was used to evaluate the significance of linear trends.
Results: Overall, 24,285 new MS admissions were reported from 2018–2022. The national MS incidence was 43/10,000 live births, with the Acholi region being the most affected (71/10,000). MS rates declined from 48/10,000 live births in 2018 to 37/10,000 in 2022 (p=0.02). Significant regional declines occurred in 6 (Kigezi, Tooro, North central, South central, Ankole, and Kampala) of 15 regions; increases occurred in Teso (p=0.049). Maternal deaths attributable to sepsis declined from 22% in 2018 to 8.6% in 2022 (p=0.005), and the average case-fatality was 1.8%.
Conclusion: There was a significant decline in maternal sepsis incidence and maternal deaths attributable to sepsis from 2018 to 2022, with the maternal deaths attributable to sepsis target nearly achieved in 2022. This reduction in maternal deaths attributable to sepsis was due to a decrease in maternal sepsis incidence, rather than case-fatality rates. A study to understand the high MS admission incidence in Acholi region may support interventions to continue to reduce MS in Uganda.

Background

Pregnant and postpartum women easily develop infections that rapidly progress to sepsis (1). Maternal sepsis is a pregnancy-related life threatening condition characterized by an organ dysfunction due to infection during pregnancy, childbirth, after delivery, or after an abortion (2). Maternal sepsis presents with the following signs and symptoms; higher or lower temperature, mental confusion, sleepiness, difficulty in rousing, severe pain, or discomfort(2).

While sepsis affects people of all ages, some groups are more likely to be affected. These include very young children, older adults, and those with a weakened immune system such as pregnant women, HIV patients, and malnourished individuals among others(3). Physiological, immunologic, and mechanical changes that occur in pregnancy make pregnant women more susceptible to infections than non-pregnant women and may obscure signs and symptoms of infection and sepsis, resulting in a delay in the recognition and treatment of sepsis(4). Sepsis is a medical emergency that requires urgent attention and rapid treatment for survival. Sepsis can be treated and, in many instances, lives are saved by using existing and proven protocols(5). Many individuals fully recover from sepsis, while others may have long-lasting effects, such as amputations or organ dysfunction, like kidney failure. When poorly managed or undetected, maternal infections can result in to sepsis, mortality, or disability for the mother, and an increased likelihood of early neonatal infection (4). Additionally, maternal infections can have serious impacts on the health of women and neonates including chronic pelvic inflammatory disease, ectopic pregnancy, and infertility (6). The risk of sepsis can be reduced by preventing or quickly identifying and managing infections. This includes practicing good hygiene, staying current with vaccinations, and seeking treatment when infections are suspected(7).

Globally, over a million neonatal deaths have been reported to be attributed to maternal sepsis annually(8). Even though effective prevention, early identification, and adequate management of

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maternal sepsis can contribute to reducing the burden of sepsis as an underlying and contributing cause of morbidity and mortality, maternal sepsis is the third leading cause of maternal deaths contributing to 10.7% of preventable maternal mortality cases in low-income countries(9). The United Nations (UN) report estimated 287,000 maternal deaths globally in 2020, with 70% of the maternal deaths occurring in sub-Saharan Africa (10). Uganda is one of the sub-Saharan countries with the highest maternal mortality ratio estimated at 336 per 100,000 live births(11). According to the annual maternal perinatal surveillance and response report of 2018/19, maternal sepsis is the second leading cause of maternal deaths in Uganda contributing to 13% of the deaths(5).

Uganda has implemented several interventions to avert maternal sepsis and deaths. One key such intervention is the Maternal and Perinatal Death Surveillance and Response (MPDSR), which is aimed at identifying, notifying, auditing, and learning from each maternal death to prevent future deaths. Other interventions implemented to combat maternal sepsis in Uganda include: improving Water, sanitation, and hygiene (WaSH) in health facilities, increasing antenatal care coverage, improving the proportion of births attended to by a skilled birth attendant, and training health workers in Basic Emergency Obstetric and Newborn care, as well as Comprehensive Emergency Obstetric Newborn care(12)(13)

Despite these interventions, the annual maternal sepsis admission in Uganda increased between 2013 and 2017 from 28/10000 live births to 50/10000 live births (14). There was little information on the current national level incidence of maternal sepsis in Uganda despite the fact that health facilities and districts generate and report data in the District Health Information System (DHIS2) every month. We assessed the trends and distribution of maternal sepsis incidence, maternal deaths attributable to sepsis, and maternal sepsis case-fatality rate, Uganda, 2018-2022, to inform programming.

Methods

Study design, setting, and data source

We conducted a descriptive analysis of pregnancy related maternal sepsis surveillance data generated from the entire country through the DHIS2. According to the Uganda Bureau of Statistics, 24.6% of the Ugandan 41,584,000 population were women of childbearing age(15). Maternal sepsis services are offered at the level of National Referral Hospitals, Regional Referral Hospitals, General Hospitals, Health Centre IVs, and Health Centre IIIs. (16)

Uganda is divided into 15 health regions, namely; Bugisu, Ankole, Kigezi, South Central, North Central, Tooro, Teso, West Nile, Bunyoro, Bukedi, Lango, Karamoja, Kampala, Busoga, and Acholi regions (17).

Study variables, data abstraction, and analysis

We abstracted data on sepsis-related to pregnancy (cases and deaths), maternal deaths, and deliveries in a health unit (live births) from the aggregate data of HMIS 108. We considered HMIS 108 (in-patient) data because the computation of maternal sepsis incidence would be more accurate since the denominator of live births was more readily available for health facility deliveries. We also obtained data on the national reporting rates on maternal sepsis for the years 2018 to 2022 from DHIS2 to determine the relationship between reporting rates and maternal sepsis incidence.

The data extracted from the DHIS2 was exported to Microsoft Excel and then into Stata 14.0 for analysis. To obtain maternal sepsis incidence, we used a proxy indicator of maternal sepsis admissions at the health units. We therefore, divided maternal sepsis cases by the total number of live births at the units and then multiplied by 10,000 per year from 2018 to 2022 at the district, regional, and national levels. The Maternal deaths attributable to sepsis was calculated by dividing the maternal sepsis deaths by total maternal deaths and multiplied by 100. We also calculated the maternal sepsis case fatality rate, by dividing maternal sepsis deaths by the total number of maternal sepsis cases and multiplied by 100. We demonstrated the regional and national trends for maternal sepsis incidence, maternal deaths attributable to sepsis, and case-fatality rate using line graphs. We performed the Mann-Kendall test to determine the existence of change in the trend of maternal sepsis incidence, maternal deaths attributable to sepsis, and case-fatality rate, and to evaluate the significance of linear trends. We also drew choropleths maps using QGIS 3.22.3 to show geographical distribution of maternal sepsis rates by district of Uganda.

Ethical considerations

We conducted a descriptive analysis study using aggregated maternal sepsis surveillance data from all the health facilities across the country that report through the District Health Information System version 2 (DHIS2). The Ugandan MoH authorized us to conduct the study. This activity was also reviewed by the US CDC and was conducted consistent with applicable federal law and CDC policy. § §See e.g.,

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45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq. The office of the Center for Global Health, US Center for Disease Control and Prevention determined that this activity was not human subject research and with its primary intent being for public health practice or disease control.

Data collected did not contain any individual personal identifiers and information was stored in password-protected computers, which were inaccessible by anyone outside the investigation.

Results

Trend of maternal sepsis incidence at health facilities, Uganda, 2018-2022

There were 24,285 new cases of maternal sepsis reported from 2018–2022. The maternal sepsis incidence rates in Uganda declined from 48 cases per 10,000 live births in 2018 to 37 cases per 10,000 live births in 2022 (p=0.02), with the highest decline reported between 2020 and 2021(Figure 1). The reporting rates were consistently high between 85 and 89% throughout the study period.

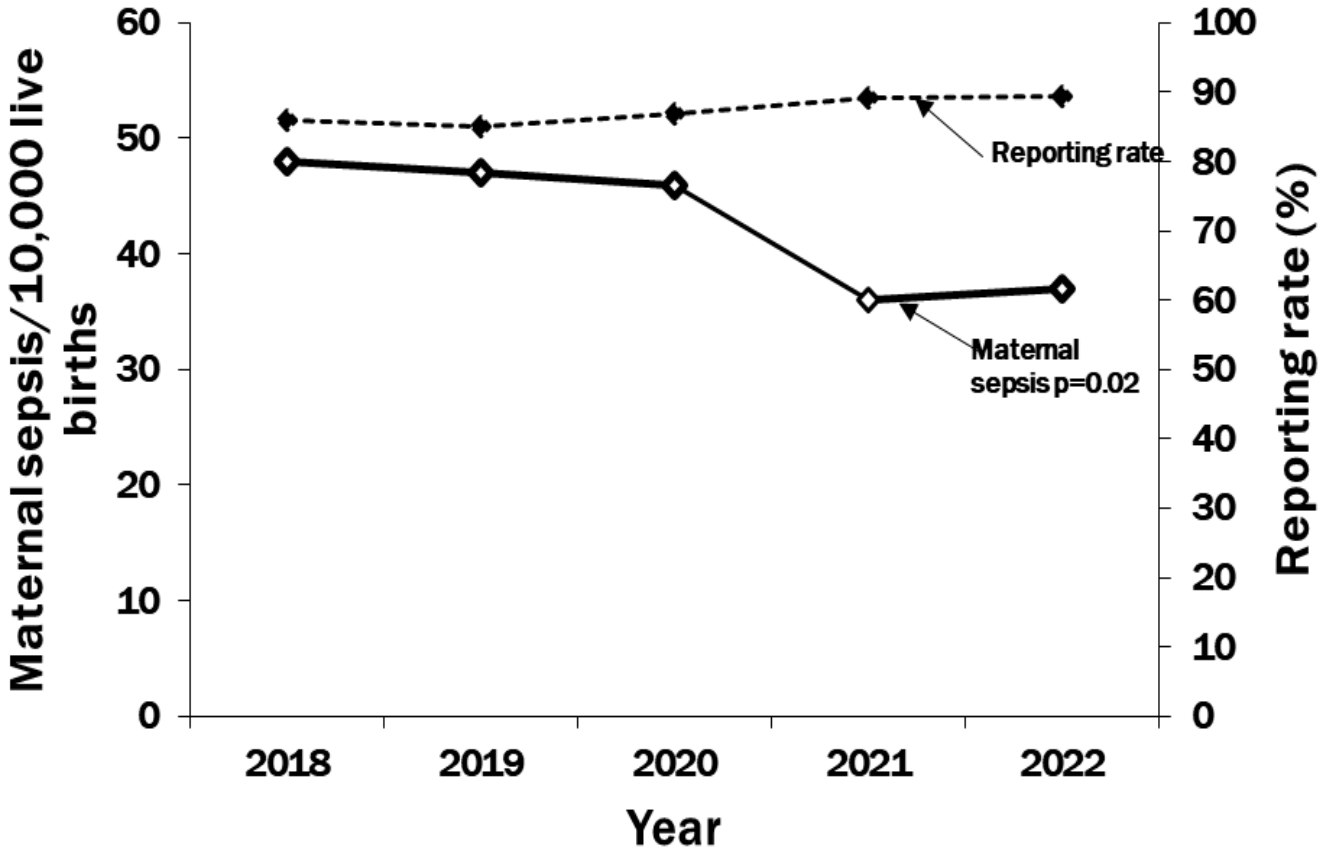

Figure 1: Trends of maternal sepsis incidence and reporting rates, Uganda, 2018–2022

Distribution of maternal sepsis incidence at health facilities by region, Uganda, 2018-2022
All the 15 regions in Uganda reported maternal sepsis cases and 6 of them showed a significant decrease in maternal sepsis incidence from January 2018 to December 2022. Teso Region, was the only region with a significant increase in maternal sepsis incidence from 39 maternal sepsis cases per 10,000 live births to 64 maternal sepsis cases per 10,000 live births (p=0.049) (Figure 2).

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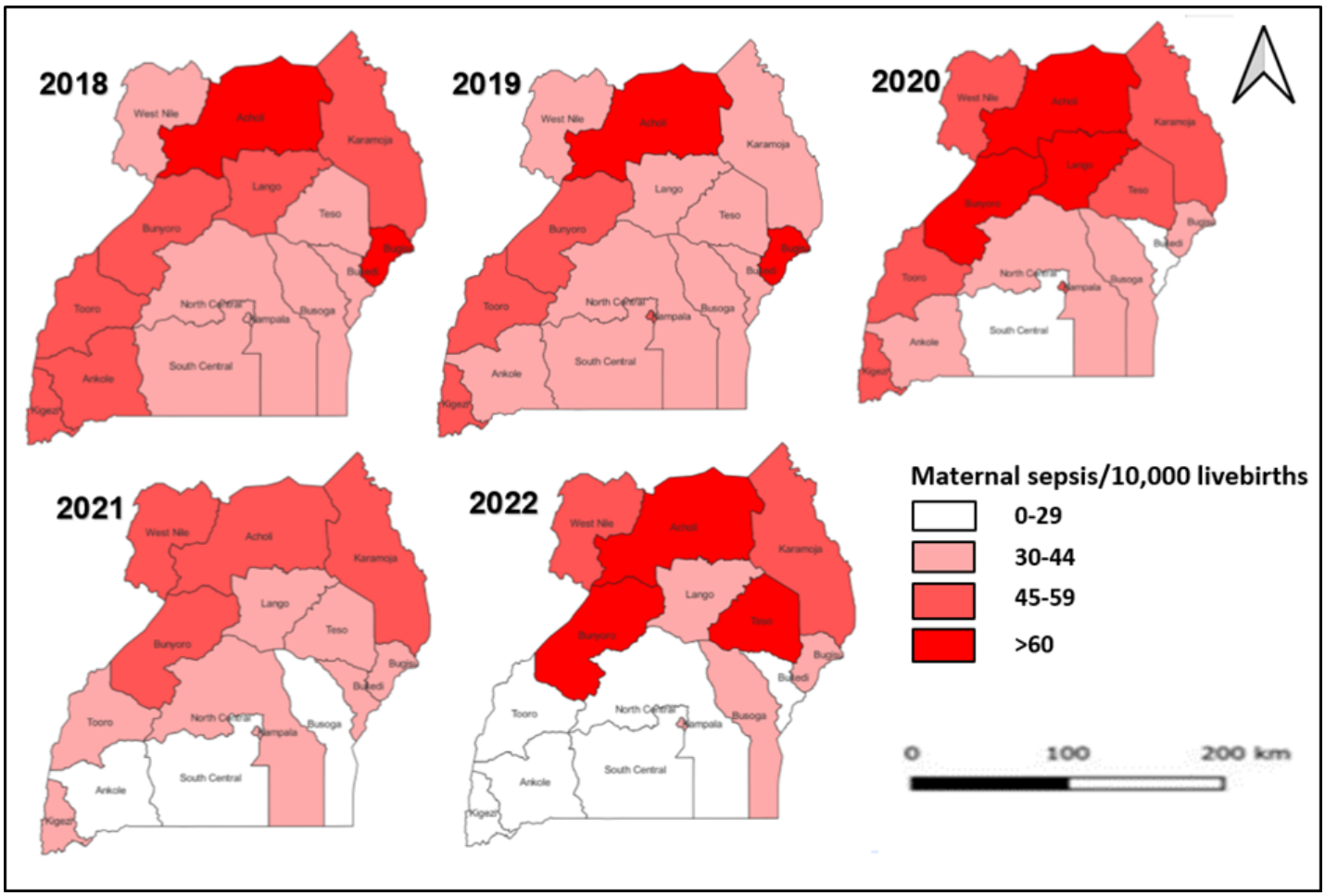

Figure 2: Distribution of maternal sepsis incidence at health facilities by region, Uganda, 2018 –2022

Distribution of maternal sepsis incidence at health facilities by districts, Uganda, 2018–2022
Nwoya District had the highest maternal sepsis incidence in both 2018 (139/10,000 live births) and 2019 (341/10,000 live births), Amudat District had the highest incidence in 2020 (244/10,000 live births) and 2021 (201/10,000 live births, and Amuria District had the highest incidence in 2022 (273/10,000 live births) (Figure 3). Nwoya District was the most affected throughout study with an average maternal sepsis incidence of 198/10,000 live births. This was followed by Moroto 136/10,000 live births, Amudat 125/10,000 live births, Kitgum 112/10,000 live births, and Hoima 95/10,000 live births.

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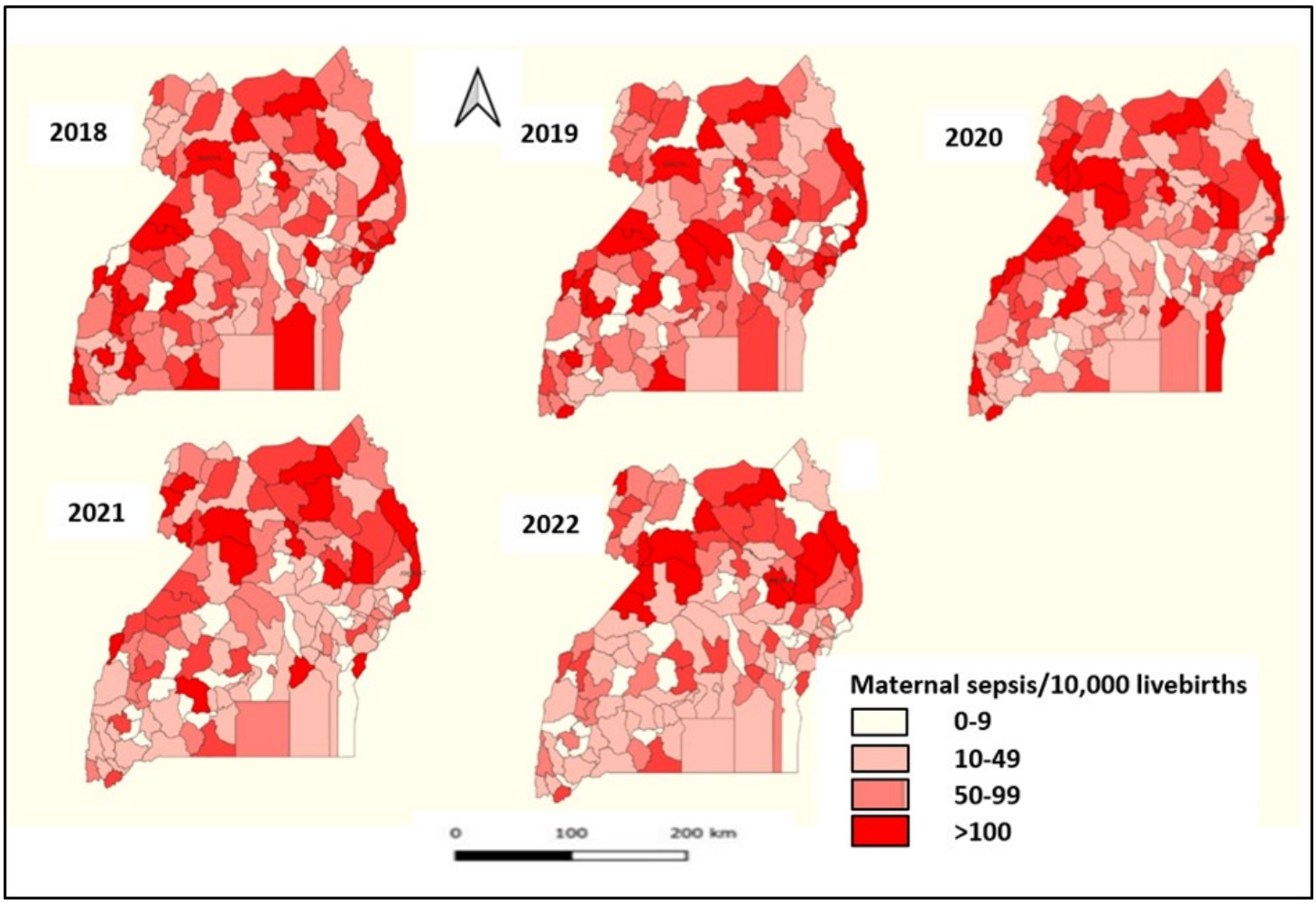

Figure 3: Distribution of maternal sepsis admissions at health facilities by district, Uganda, 2018–2022

Trend of maternal deaths attributable to sepsis in Uganda, 2018–2022

There were 479 maternal deaths due to maternal sepsis reported from 2018-2022. The proportion of maternal deaths that were due to sepsis was 21% in 2018. There was a decline in maternal deaths due to sepsis from 21 % in 2018 to 9 % in 2022 (Figure 4). Lango and Acholi regions had the highest average maternal deaths attributable to sepsis at 13 % through 2018-2022, while Bukedi was least affected at 3%.

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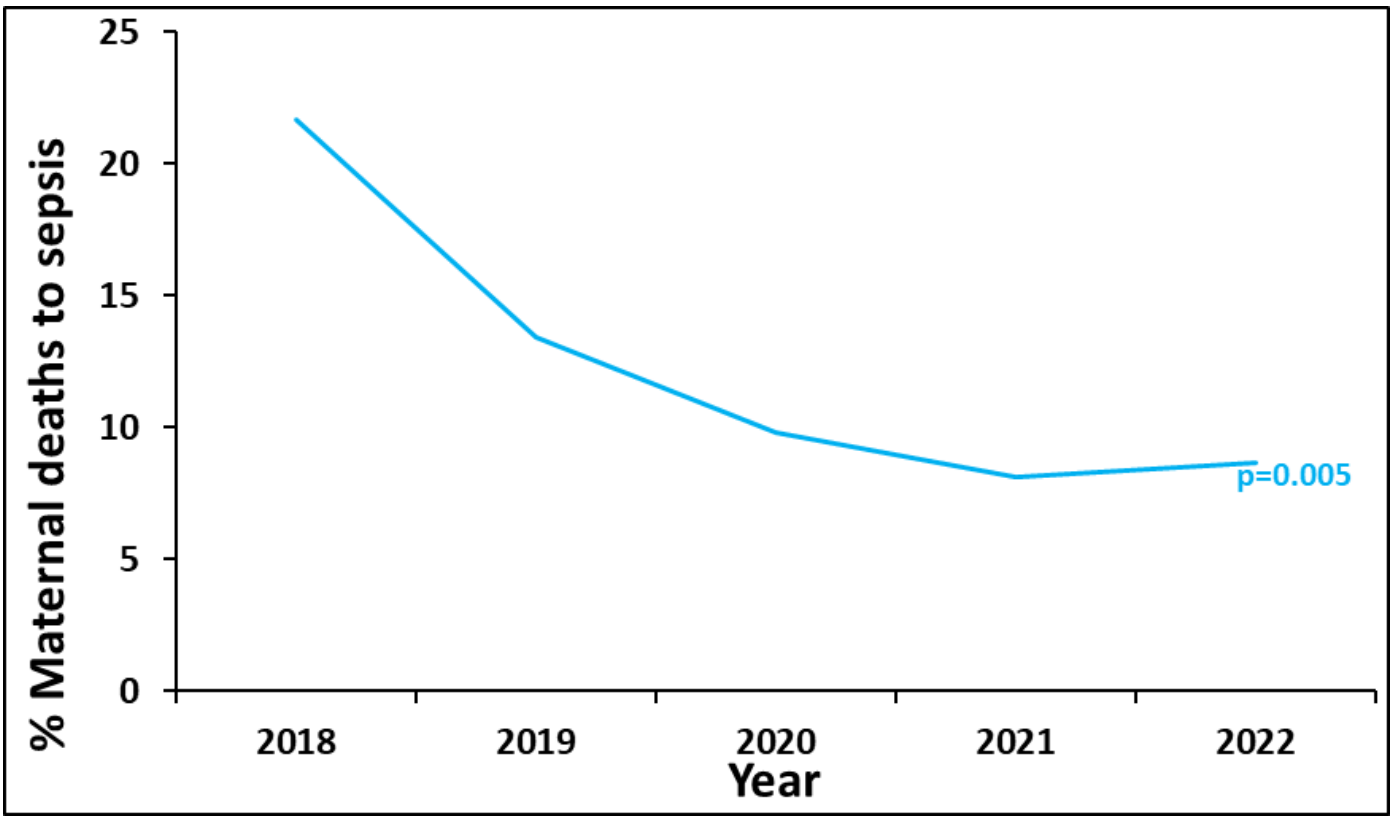

Figure 4: Maternal deaths attributable to sepsis, Uganda, 2018-2022.

The trend of maternal sepsis case-fatality rate, Uganda, 2018–2022

There was no significant change in the maternal sepsis case-fatality rate (p=0.2207) through 2018-2022 (Figure 5). The maternal sepsis case fatality rate slightly changed from 2.4% in 2018 to 1.7% in 2022. The national average maternal sepsis case fatality rate was 1.8% from 2018-2022. Ankole (2.7%), North Central (2.5%), and Bugisu (2.3%) had the highest average maternal sepsis case fatality rates during the period of study, while Bukedi had the least CFR at 0.5%.

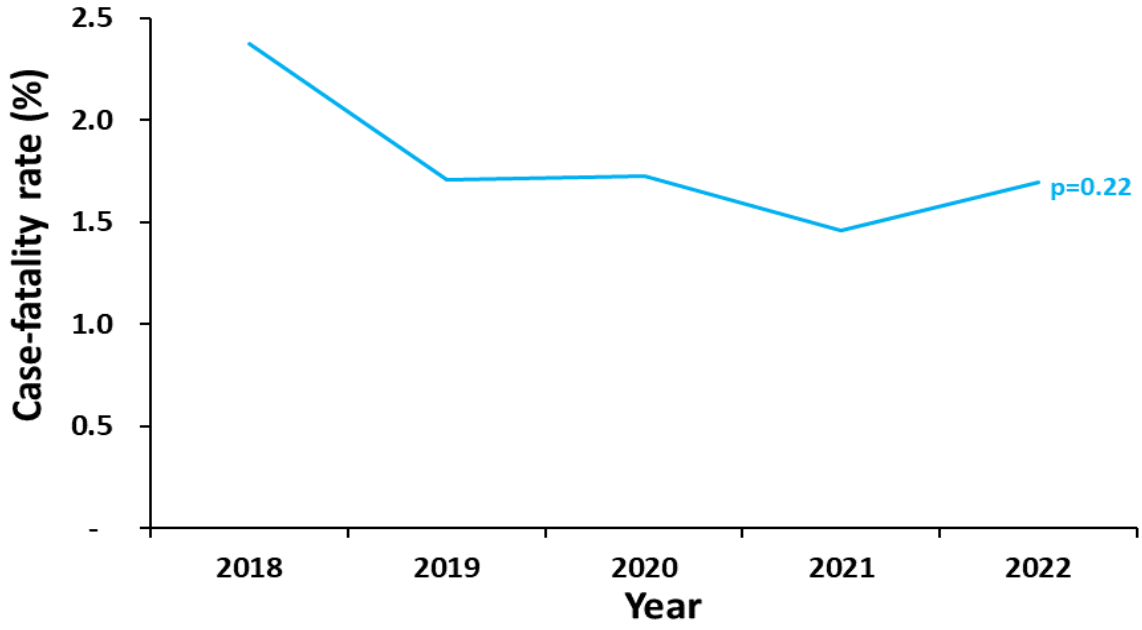

Figure 5: Distribution of case fatality rates of maternal sepsis in Uganda, 2018-2022

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Discussion

We studied the trends and distribution of maternal sepsis in Uganda from 2018 to 2022. The maternal sepsis rates at health facilities in Uganda declined through the study period. The southern region of the country saw reductions in maternal sepsis rates, while the northern area of the country remained unchanged. Teso region was the only region with a significant increase in maternal sepsis rates. Maternal deaths attributable to sepsis declined and the case-fatality rate did not change.

The maternal sepsis incidence of 37 cases per 10,000 live births in 2022 in Uganda was low compared to a study conducted in Ethiopia on the incidence and predictors of puerperal sepsis among postpartum women that found maternal sepsis incidence at 70 cases per 10,000 live births(18). Another study conducted in 52 countries estimated sepsis to affect 109 cases per 10,000 live births. Women from low-income countries like Uganda had the highest sepsis rates at 151 cases per 10,000 live births (19). The decline in maternal sepsis incidence could be due to improved antenatal care coverage with up to 95% of pregnant women attending at least one antenatal care visit from skilled health personnel in the country as reported by the 2022 Uganda Demographic Health Survey (UDHS) (20). According to the WHO Global Maternal Sepsis Study on the aetiology and use of antibiotics in pregnancy-related infections, genital infections and urinary tract infections were the most frequent risk factors for maternal sepsis and these can be identified and managed during quality antenatal care (5).

The increased proportion of pregnant women giving birth in health facilities under the care of skilled birth providers could further explain the decline in the maternal sepsis incidence in the country since most of the risk factors related to developing maternal sepsis are assessed, identified and managed during skilled birth attendance (21). The decline in maternal sepsis incidence is a significant progress towards improving maternal and child health services and a key step to the achievement of both target 3.1 (maternal mortality reduction) and target 3.2 (neonatal mortality reduction) of the Sustainable Development Goals(22).

Maternal sepsis incidence was high in the northern area of the country. The findings were in agreement with the findings of a study that was conducted to assess the trend and distribution of puerperal sepsis in Uganda that indicated northern region was one of the most affected regions with sepsis contributing up to 24% of the maternal deaths (23). The high maternal sepsis incidence in northern region could be due to the low coverage of skilled birth attendance of 50% (15).The low skilled birth attendance is likely associated with mothers seeking for care at later stages with complications that could predispose them to sepsis (24). According to Urendi (2023) in a study on traditional birth attendants and associated factors among pregnant mothers in selected communities in northern Uganda, traditional birth attendance was reported at 58%(25). The low skilled birth attendance could be due to this high traditional birth attendance in the region with participants citing long distances to health facilities, family influence, and low socioeconomic status as significant factors associated with traditional birth attendance.

The decline in maternal deaths attributable to sepsis was consistent with the results of the systematic review of studies on causes of maternal mortality in Sub-Saharan Africa that revealed maternal sepsis contributed 11% of the maternal deaths (26). However, the maternal sepsis contribution of 8.6% to maternal deaths was low compared to the 16.5% of a study done in 2020 at a regional referral hospital in south western Uganda, that focussed on the factors associated with severe maternal outcomes (27). This is probably due to the regional variations observed in this study as the southern region saw reductions in maternal sepsis rates, the northern area remained unchanged, and Teso region a significant increase in maternal sepsis incidence. Given that Teso region had a good skilled birth attendance at 74%, the increase in maternal sepsis could have been due to poor infection, prevention and control measures at health facilities(11). Maternal sepsis is the second largest cause of preventable maternal deaths in Uganda (8),thus the decline in maternal sepsis incidence significantly reduces maternal mortality. This was evidenced by the coincidental reduction of the maternal mortality ratio in Uganda from 336/100,000 live births in 2016 to 189/100,000 live births in 2022 (20).

Study limitations

This analysis was based on the quality of data reported by the health facilities into the DHIS 2, the cases reported in DHIS2 only include those that have reached health facilities, leading to an underestima-

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porting rate through the period of study was 87%. This likely led to underestimates of total cases in the study period; however, since we were comparing rates, it may or may not have affected the interpretation of results. We also verified the accuracy of the reported data by reviewing the regular data quality assessment reports(28). Furthermore, maternal sepsis diagnosis in resource-limited settings like Uganda does not have to be laboratory-confirmed. This may have led to over diagnosis.

Conclusion

Uganda registered a significant decline in maternal sepsis incidence and maternal deaths attributable to sepsis from 2018–2022, with the target of <8% of maternal deaths due to sepsis by 2024; nearly achieved in 2022. The decline in maternal deaths attributable to sepsis was due to a reduction of Maternal Sepsis incidence, but not case-fatality rates. We recommended that the Ministry of Health and its partners focus on intensified infection prevention and control practices at health facilities, and sensitization of health care providers and mothers on the presentation, cause, prevention, and management of maternal sepsis as this may further reduce both the incidence and case-fatality rates.

A study to understand the high Maternal Sepsis incidence in the northern area may support interventions to continue to reduce Maternal Sepsis in Uganda.

Conflict of interests

The authors declare that they have no competing interests.

Author's contribution

LT, RM, and RM participated in the conception, design, analysis, interpretation of the study, and wrote the bulletin; BK, RM, DK, RM, RM, IN, and ARA reviewed the drafts of the bulletin for intellectual content and made multiple edits to the draft bulletin. All authors contributed to the final draft of the bulletin. All the authors read and approved the final bulletin.

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Improvement of Sample Receipt Turnaround Time for HIV Viral Load using a Continuous Quality Improvement Approach, Kigezi, Uganda, April-September 2023

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Summary

Background: Uganda has an established national sample transport and referral network based on the hub-and-spoke model. All health facilities' samples are expected to be received within 7 days at the Central Public Health Laboratory (CPHL). However, from October to December 2023, only 1(1%) of health facilities' samples in Kigezi region were received within 7 days. We conducted a continuous quality improvement (CQI) project to reduce the sample receipt turnaround time.

Methods: A Continuous Quality Improvement (CQI) team was formed to coordinate the implementation of the CQI project, conducted stakeholder meetings, and used root-cause analysis techniques to identify the total control root causes and these were prioritized. Interventions included performance review meetings, improved coordination, communication, and timely data review. Progress was monitored using a quality indicator.

Results: Reasons for long sample receipt included poor coordination and communication. At baseline from April to May 2023, only 2 (2%) of spoke health facilities had samples received at CPHL and 52 (71 %) of spoke health facilities had samples received at CPHL in ≤7 days at end line.

Conclusion: Performance review meetings with hub coordinators, riders and spoke health facility staff as well as strengthening coordination and communication improved sample receipt turnaround time in Kigezi region.

Background

A specimen referral network is a coordinated system that allows a health facility or laboratory lacking the capacity to perform particular tests to safely send a patient's specimen to another or higher-level laboratory with the capacity to perform the requested test (s) (1).

Uganda has a centralized specimen referral system in place. The hub-and-spoke model is where the "hub" is a central health facility that is identified to serve as a central specimen collection point for specimens coming from multiple referring sites, termed "spokes". From the hub, the specimens are transported to the reference laboratory for testing (1). In Uganda, the hub-and-spoke model was initially established for the transport of Early Infant Diagnosis (EID) samples and has since expanded to transport other sample types including HIV Viral Load samples (4). The hub is accessible to a minimum of 15 health facilities within a radius of 40km maximum and drivers and courier bikers transport samples at least weekly to the hub and from the hub to the Central Public Health Laboratory, Ministry of Health Uganda (CPHL, MOH).

Central Public Health Laboratories, Ministry of Health routinely monitors the National Sample Transportation, Referral and Results Network (NRSTN) to improve its efficiency (5). However, there are still many challenges with some regions operating sub-optimally compared to others (6). High turnaround time in the NRSTN is a prevailing challenge. The NSTRN turnaround time (TAT) is broken down into 3 sections i.e. TAT sample collection to receipt at CPHL, TAT sample receipt at CPHL to sample results dispatch (testing laboratory), and TAT sample results dispatch to sample Results Download at the facility. The sample receipt starts from when samples are collected at the spoke health facility to when the samples are received at CPHL. From October- December 2022, Kigezi region had the lowest proportion of 1 (1%) of health facilities with samples received within 7 days. We identified the factors affecting VL sample receipt turnaround time in the Kigezi region and addressed the gaps using a continuous quality improvement approach.

Methods

Project implementation setting and design

We conducted this continuous quality improvement project in the Kigezi Region, South Western Uganda, from April to September 2023.

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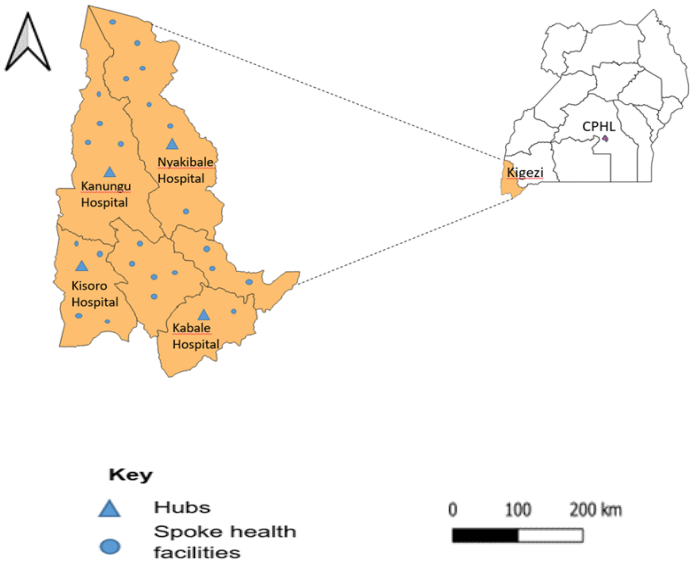

Figure 1: Location of Kigezi region in Uganda

We considered Kigezi region because of its record of high turnaround time since October 2023, according to Ministry of Health - Central Public Health Laboratories, COP21 October 2022 – December 2022 Progress Report. We applied a four-stage problem-solving model used for improving a process or carrying out change (Plan-Do-Study-Act). Using this model, we focused on 3 fundamental questions: What are we trying to accomplish? How shall we know if a change is an improvement? And what changes should we make that can result in an improvement? We defined the aim of the quality improvement project by stating what we wanted to improve, how much improvement we wanted and by when (the timeline). The Quality improvement (QI) team defined their aim, identified measures, and changes to be made for improvement. We collected weekly data on the proportion of samples that had their samples received at CPHL, MOH within 7 days. We then conducted a final evaluation to ascertain whether there was an improvement in proportion of health facilities whose samples were received within 7 days.

Ethical considerations

This study reviewed by the US CDC and was conducted consistent with applicable federal law and the US CDC policy. We also obtained administrative clearance from the Central Public Health Laboratories, Ministry of Health before study start. All generated records were kept confidential and password protected.

Results

Baseline assessment findings

A total of 4 hubs served as central specimen points to 117 spoke health facilities. Only 2 (2%) of health facilities had their samples received at CPHL within 7 days. The majority 49 (42%) of health facilities were served by Kabale Hub with no health facility having their samples received at CPHL in ≤7 days (Table 1).

Hub	Total number of health facilities	Number of health facilities with samples received at CPHL within 7 days	Percentage
Kabale hub	49	0	0
Kanungu hub	20	0	0
Kisoro hub	21	1	4.8
Nyakyibale hub	27	1	3.7
Total	**117**	**2**	**2%**

Table 1: Baseline assessment findings

Reasons for long sample receipt turnaround time in Kigezi, Uganda, April-September 2023

System factors, laboratory staff, ICT and hub rider related factors were identified as the broader causes for long sample receipt turnaround time. System factors included: wrong date written on collection form, workflow not aligned, not adhering to SOPs and writing forms before sample collection. Laboratory staff factors included; samples not ready for transportation, delayed sample packaging, and staff unavailability. ICT factors included; sub-optional sample tracking, outdated and not procuring new phones. Hub rider factors included: lack of adherence to transport schedule, adjustment of schedule, health facilities not ready on time, poor coordination and communication.

Poor coordination of the Hub riders and the spoke health facilities by the Hub coordinators as well as poor communication between Hub riders and the spoke health facilities were identified as contributory root causes within the team's total control to influence change.

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		Baseline		End line
Hub	**Total health facilities**	**Health facilities samples <7 days**	**Total health facilities**	**Health facilities samples <7 days**
Kabale hub	49	0 (0%)	28	20 (71%)
Kanungu hub	20	0 (0%)	9	6 (67%)
Kisoro hub	21	1 (5%)	13	6 (46%)
Nyakyibale hub	27	1 (4%)	20	20 (100%)
Total	**117**	**2 (2%)**	**70**	**(52) 71%**

Table 2: Baseline and end-line assessment findings

Discussion

Our study revealed a long sample receipt turnaround time at baseline. Poor coordination and communication were identified as the main root causes of long sample receipt turnaround time in Kigezi region. Performance review meetings, strengthening coordination, communication and timely review of data improved sample receipt turnaround time in the region leading to an increase in the percentage of health facilities that had their samples received at CPHL within 7 days.

Delay in sample pick up from the spoke health facilities was identified as one of the causes of delay in the study. This is in line with a study in South Africa, which showed that one of the most common issues that prolong pre-analytical TAT were delays in transport and sample collection from clinics to testing laboratories and changes in courier routes and pick-up times (7). Moreover, delay in sample transportation is one of the many causes of delayed pre-analytical TAT, which may be due to a lack of awareness of the consequences of delayed transportation on patients (8). This could also be attributed to several factors including delayed packaging at the spoke health facilities as shown by a study conducted in Bukedi region, Eastern Uganda, which also found that there were delays between the spoke health facility and hub caused by delayed packaging at spoke health facilities (9). In India, there was a long sample sorting time where the hub riders tended to wait for samples to pile up before transporting them (8).

During our study period, health facility staff including laboratory technologists, hub riders, and hub coordinators were laid off and this led to an increase in sample receipt turnaround time as a result of changes in Implementing Partners (IPs) for the Region. This is in line with other studies conducted which showed that short staffing of laboratory personnel has been noted to have a major impact on turnaround time. The throughput of the laboratory is related to many aspects of its workflow including sufficient staffing available to perform specific tasks (10). In a study conducted in India, it was found that failure to modify work schedules to coordinate available manpower, as well as a lack of manpower led to delayed turnaround time. The most impacted tests that require improvement are those for HIV viral load among other tests. Reducing delayed TAT skilled staff retention was among the many crucial strategies (11). Implementing partners also plays a pivotal role in terms of supporting laboratories to effectively manage and deliver quality services, this includes facilitating the hub coordinators

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and hub riders (6), therefore a transition of implementing partners in the region is likely to affect service delivery.

There was poor coordination and communication between hub riders and staff at spoke health facilities in our study, leading to a long sample receipt time. When staff at spoke health facilities were absent or not yet ready to prepare samples they would not communicate with hub riders. Hub riders would therefore adjust their schedule to their convenience without communicating with the health facilities or their supervisors leading to poor coordination. This was in line with a study conducted in Bukedi region which showed that there was poor communication and hub riders and staff and staff at the spoke health facilities leading to the delay of samples at the spoke health facilities, hence leading to increased turnaround time between the spoke and hub (9).

We had performance and quality management review meetings which are essential to the medical laboratory quality management system and a major opportunity for laboratory management and leadership to reaffirm its commitment to the management system and to continually improve its effectiveness. Performance review meetings are ISO 1589:2012 requirement in which is improvement of a key indicator such as turnaround time is paramount (12). In line with this, a study conducted in Bukedi region showed that the implementing partner supported the districts to hold quarterly performance review meetings to identify challenges and share learnings. This helped to reduce the turnaround time between spoke health facilities and the hub (9).

In our study, the hub coordinators were tasked to ensure the hub riders called the staff at the health facilities to improve communication and coordination. The laboratory managers were also encouraged to ensure the staff responsible for preparing the referral samples called the hub riders to ensure better coordination. Similarly, in a study in Bukedi district, cohesive coordination between the health workers and hub riders significantly improved turnaround time (9). Furthermore, a previous study in India, indicated that timely communication between healthcare workers and laboratory professionals is vital in ensuring mutual understanding and collaboration after the samples have been collected and delivered at the laboratory (13).

A weekly review of sample receipt turnaround on a WhatsApp forum was carried out during the study period. This enabled the key stakeholders to get timely information and therefore enable timely action. This is in line with a study in South Africa where it was found that adding weekly TAT component analysis at the laboratory level further identifies problematic testing weeks and possible causes of prolonged TAT. Weekly assessment of TAT and TAT components not only identified problematic testing laboratories or days with TAT challenge but also enabled the identification of individual outlier samples that can be investigated to assess causes of TAT delays (7). It has also been recommended that weekly monitoring of TAT identifies poor performance more accurately than aggregate reporting, thereby focusing on the identification of poorly performing laboratories that need immediate intervention (8). There is a need for periodic monitoring of delayed TAT and the reasons for elevated TAT and put improvement plans into place (7).

Study limitations

Only data entered into the Laboratory Information Management System (LIMS) was used for our study because the monitoring of TAT using the sample tracking system was limited. This was due to the stock-out of sample tracking barcodes. Strengthening the sample tracking system could provide valuable additional date and time values to allow for a more comprehensive TAT review.

Conclusion

Sample receipt turnaround time in Kigezi region improved through cohesive coordination between the health workers and hub riders. There should be continuous strengthening of coordination and coordination between health workers and hub riders.

Conflict of interest

The authors declare that they have no conflict of interest.

Authors Contribution

LNB, HN, FN and SG conceived and designed the analysis. LNB, HN, FN, and SG collected the data. LNB, HN, FN and SG contributed to the data analysis. LNB, HN, FN and SG performed analysis.

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and Baylor Uganda for support and oversight of this project. We also acknowledge the US Centers for Disease Control and Prevention Uganda for implementation support. We also thank Kigezi Regional stakeholders for the implementation and coordination of this project.

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Measles Outbreak Investigation in Terego District, Uganda, May- June, 2024

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Summary

Background: The Ministry of Health (MoH) received a notification of a measles outbreak in Terego District, Uganda, on April 30, 2024. We investigated to determine the scope of the outbreak, assess risk factors for transmission, Vaccine effectiveness (VE), Vaccine coverage (VC), and recommend evidence-based control and prevention measures.
Methods: We defined a suspected case of measles as onset of fever and maculopapular rash, plus ≥1 of the following; cough, runny nose (coryza) conjunctivitis (red eyes) in a resident of Terego District from February 1, 2024 to June 1, 2024. A confirmed case was defined as a suspected case that tested positive for IgM measles-specific antibody test. We identified case-patients in health facility registers and active case searched to update the line-list using our case definitions. We conducted a 1:1 unmatched case-control study and used logistic regression to identify exposures associated with measles infection. We estimated vaccine coverage and effectiveness in the district.
Results: We identified 136 case-patients (132 suspected case-patients and 4 confirmed case-patients and no deaths). The index case had returned from Ediophe HCIII in Arua City where she was co-caretaking a relative's child that had been admitted on ward with measles-like symptoms. The median age was 4.1 years (IQR: 1.5-9) and 0-6 months age group was the most affected with AR (220/100,000). Females were more affected (AR=64/100,000) compared to males (AR=42/100,000). Vaccination was 60% protective against measles (aOR=0.4, 95% CI=0.2,0.8). Visiting any health facility (aOR=4.4, 95% CI=1.4,14), attending a public gathering (aOR=4.9, 95%CI=2.01, 12), and visiting a place of worship (aOR=19, 95%CI=1.8, 206) were associated with acquisition of measles disease. VE was 60% (95% CI=20-80) and VC was 71%.
Conclusions
The measles outbreak in Terego District was imported from Arua City and facilitated by suboptimal vaccine effectiveness, low vaccine coverage in the affected sub counties, nosocomial spread in health facilities, and community gatherings. The district should take deliberate measures to improve routine immunization coverage to strengthen herd immunity thereby mitigating risk of future measles outbreaks.

Background

Measles is a highly contagious disease caused by the measles virus. The disease is spread from person to person through inhalation of infected respiratory droplets, within an incubation period of 7-21 days (1). Due to its high infectivity rate, where one infected individual averagely transmits the disease to 12 to 18 individuals in a susceptible population, it has been associated with several outbreaks globally (2).

Since 2018, measles has been one of the leading causes of morbidity and mortality among the vaccine preventable diseases in children <5 years (3). In 2022, there was a global rise in measles case-patients by 18% and measles deaths by 43% compared to 2021, approximating to 9 million case-patients and 136,000 deaths. The rise was due to disruptions in the healthcare

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contributed halfway to the burden of measles case -patients in the world, with Sub-Saharan Africa exhibiting the highest number approximating to 17,500 measles case-patients (5). In Uganda, measles is the most reported outbreak(6).

Furthermore, it is important to note that immunization is the most effective way to reduce measles infections and transmission. Despite availability of measles vaccines, given in 2 doses in Uganda, the country is still faced with increasing numbers of measles outbreaks each year, often affecting children under 5 years of age (8) . In January 2024, the country faced 8 measles outbreaks in 8 districts including Terego (9). On April 30, 2024, Ministry of Health received a notifica

tion about a measles outbreak in Terego District, through the Public Health Emergency Operations Centre (PHEOC). This occurred after four out of seven samples tested from the Uganda Virus Research Institute (UVRI) turned positive for Measles specific IgM antibodies. We investigated to determine the scope of the measles outbreak, assess risk factors for transmission, vaccine coverage, and effectiveness, and recommend evidence-based control and prevention measures.

Methods

Outbreak setting

Terego is a new rural district in West Nile part of northern Uganda, established in 2020. It has a population of 394,319 people, which consists of natives and refugees from 2 refugee settlements. The district comprises of seven sub-counties (SC): Aii-Vu, Bileafe, Katrini, Odupi, Omugo, Uriama, Leju Town council and 39 parishes, with its headquarters in Leju town council (10). The measles outbreak occurred in 5 sub-counties; Aii-Vu, Omugo, Udupi, Uriama and Leju Town council.

Case definition and finding

We defined a suspected case of measles as onset of fever and maculopapular rash, with one or more of the following: cough, runny nose (Coryza) or conjunctivitis (red eyes) in a resident of Terego District from February 1, 2024 to June 1,2024**.** A confirmed case was a suspected case that has been confirmed positive for IgM measles-specific antibody test.
We reviewed patient records to identify measles case-patients that visited health facilities in Terego District since February, 2024, and updated the line list. Leju Town council had the highest number of case-patients compared to the other sub-counties, and we selected it for active case search. We actively searched for additional case-patients at Obofia HCII and communities in Leju Town council, with the help of the Health Assistants (HAs) and Village Health Teams (VHTs). Obofia HCII is the major health facility serving people from far and wide in Leju Town council. We interviewed case-patients using a standard Case Investigation Form (CIF) to obtain information on demographic characteristics, clinical features, vaccination and social history. Vaccination history was assessed by vaccination card availability and recall of the parent with demonstration of knowledge on site of vaccination.

Descriptive epidemiology

We described the line-listed case-patients by place, person, and time. Person characteristics included sex and age. We used 2024 population projections from the Uganda Bureau of Statistics (UBOS) to obtain the mid-year population for the different age groups for Terego District to calculate the attack rates by age and subcounty. Using the Quantum Geographic Information System (QGIS) software, we constructed choropleth maps to display attack rates by place. We summarized distribution of case-patients by time of skin rash onset using an epidemiological curve.

Laboratory investigations

Whole blood was collected from 7 suspected case-patients for measles IgM antibody testing.

Environmental assessment

We observed the turn up for vaccination at Obofia HCII and movement of people outside Terego District and from neighboring districts and countries like Democratic Republic of Congo. We interviewed caretakers, health care workers at the HCII, and the Local Council V chairperson to obtain information regarding people's perceptions about measles and measles vaccinations, and possible causes of the measles outbreak in the district. We observed for

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control measures instituted by the caretakers with children suffering from measles during home interviews.

Hypothesis generation

We conducted 30 hypothesis generating interviews using a measles case investigation form. Case-patients or their caretakers were interviewed on a number of potential risk factors that occurred within three weeks prior to symptom onset, such as: visiting a health facility, travelling outside Terego, being vaccinated, close proximity to someone with a rash during church service and playing away from home.

Case control study

We conducted a 1:1 unmatched case-control study to evaluate the possible risk factors that emerged during hypothesis generation. The study focused at Leju Town council since it had the highest attack rate for measles compared to the other six sub counties. A control was defined as a person residing in Terego District with no history of fever or rash from February 1, 2024 to June 1, 2024. Controls were obtained from neighborhood (who had not had a measles case before) to ensure both case-patients and controls had comparable exposures. An interviewer-administered questionnaire was used to obtain information on demographics, clinical characteristics, and other risk factors to measles disease. We used logistic regression to identify factors associated with measles transmission.

Vaccine Effectiveness (VE)

We estimated vaccine effectiveness for measles vaccine using the formula VE=1-aOR where aOR were the protective odds (adjusted OR from logistic regression) of having been vaccinated at least once with MR vaccine.

Vaccine Coverage (VC)

We estimated vaccine coverage using the proportion of eligible vaccinated respondents among the control group.

Ethical considerations

This outbreak investigation was conducted in response to a public health emergency by the National Rapid Response Team. The Ministry of Health (MoH) gave permission to investigate this outbreak. In addition, a non-research determination clearance from the US Centers for Disease Prevention and Control (US CDC) was sought. The investigation was approved by US CDC and conducted in accordance to the applicable US federal laws. § §See e.g., 45 C.F.R. part 46, 21 C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq.

We sought permission to conduct the investigation from District health authorities of Terego District. Since the investigation presented no more than minimal risk of harm and involved no procedures for which written consent is normally required, we sought verbal informed consent or assent for interviews, from the respondents. We ensured privacy during all interviews and case-patients information was kept confidential throughout the investigation period and beyond.

Results

Descriptive epidemiology

Overall, 136 case-patients (AR=53/100,000) were identified including 4 confirmed case-patients and no deaths. The median age was 4.1 years (IQR=1.5-9). Case-patients with age group 0-6 months were the most affected (AR=220/100,000 case-patients) followed by 1-4 years (AR=110/100,000). Females were more affected (AR=64/100,000) than males (AR=42/100,000). Among the seven sub-counties, Leju Town Council was the most affected (AR=793/100,000), followed by Omugo (AR= 18/100,000), Uriama (AR=8/100,000), Udupi and Aii-Vu each (AR= 2/100,000). Two sub-counties; Bileafe and Katrini did not register any measles case-patients (Figure 3).

Measles transmission occurred rapidly from one person to another. The primary case was a 5 months old male, AB from Leju TC who developed skin rash on March 2, 2024. He had no history of travel outside Terego District or household contact with a case or transmission to any member of the household. In this outbreak, the index case was a 36-year-old woman, BB from Osua village, Leju T/

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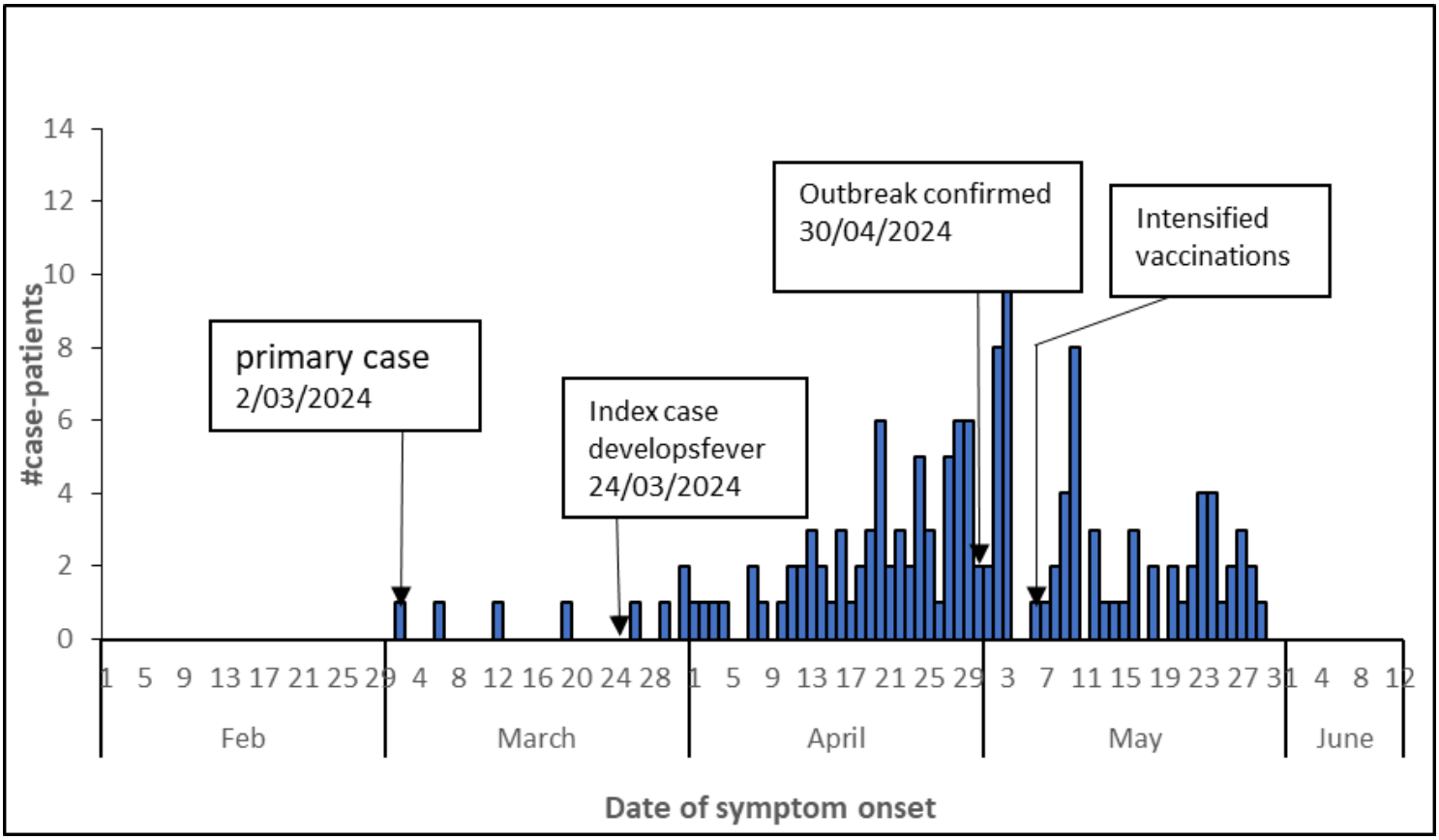

Figure 2: Distribution of case-patients by date of rash onset, during a measles outbreak in Terego District, May-June, 2024

with similar signs and symptoms on the ward. On April 17, 2024 samples from 7 people were taken off

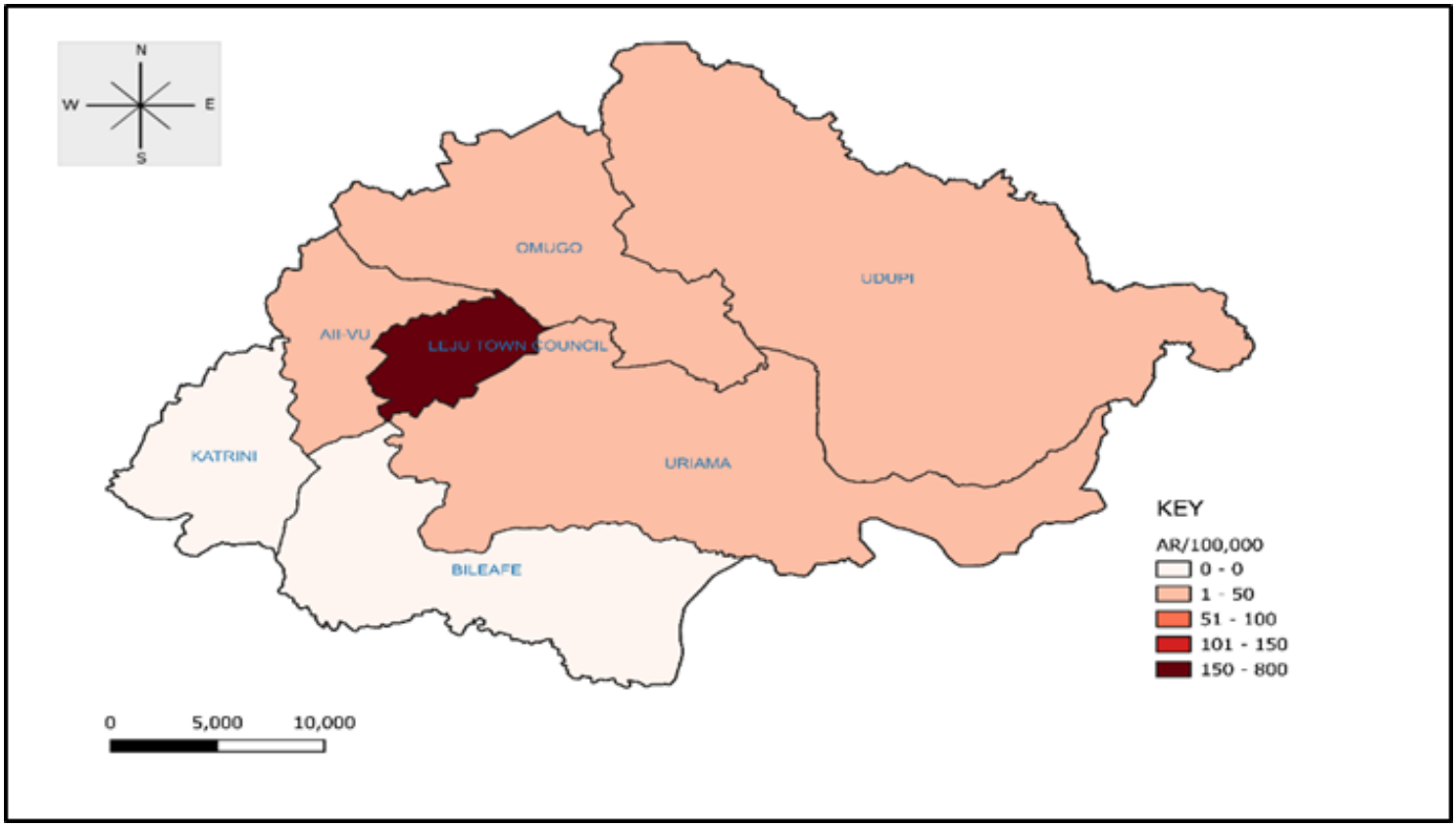

Figure 3: Attack rate by sub-county during a measles outbreak in Terego District, Uganda, February-June 2024

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and sent to UVRI, 4 of which including the one for the index case tested positive for IgM antibodies. On April 30, 2024 Ministry of Health (MoH) declared an outbreak for measles in Terego District. Several suspected case-patients were line listed thereafter and from May 06, 2024 supplementary immunization campaigns were intensified. There were no new reported case-patients since May 29, 2024 (Figure 2).

Potential risk factors	Case-patients (%)
Close proximity to someone with a rash during church service	30 (100)
Not vaccinated against measles	26 (87)
Playing away from home	26 (87)
Visiting a health facility within 3 weeks prior to symptom onset	22 (73)
Travelling outside Terego within 3 weeks prior to symptom onset	21 (70)

Environmental assessment findings

Many mothers deliver from government health facilities in the nearby sub counties and leave their children's immunization cards there. These cards are kept by the health workers to avoid being misplaced by the mothers. As a result, mothers are not aware of the next vaccination appointments and hence do not return back to Obofia HCII for their children's vaccinations. We also observed that sick children (with measles) were not isolated at home and instead lived normally with the rest of the family members, thereby further spreading the measles infection in the household. Interviews with the LCV revealed that people in the communities were not aware of MR2 vaccine presence and their children were vaccinated only with MR1.

Hypothesis generation findings

Potential risk factors to measles transmission were: Being in close proximity to someone with a rash during church service, not vaccinated against measles, and playing away from home (Table 1). We

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Table 2: Risk factors for measles outbreak investigation in Terego District, Uganda, February-June 2024

Risk factor	Number (%exposed)		cOR (95% CI)	aOR (95% CI)
	Case-patients n (%)	Controls n (%)		
Vaccinated against measles	27(34)	57(71)	0.2 (0.1-0.4)	0.4 (0.2-0.8)
Attending a public gathering	59 (74)	17(21)	10 (5.01-22)	4.9 (2.01-12)
Current school attendance	17(71)	12(86)	0.4 (0.04-2.7)	
Received a visitor from Arua City	12(15)	4(5.0)	3.4 (0.95-15)	3.5 (0.7-18)
Received a visitor from South Sudan	6(7.5)	1(1.3)	6.4 (0.7-298)	
Sharing a water source	59 (74)	41(51)	2.7 (1.4-5.2)	1.1 (0.5-2.6)
Visiting a place of worship	79(99)	69(86)	13 (1.6-100)	19 (1.8-206)
Visiting any health facility	32 (40)	6(7.5)	8.2 (3.2-21)	4.4 (1.4-14)

cOR refers to crude Odds Ratio aOR refers to adjusted Odds Ratio

At multivariable analysis, vaccinated individuals were 60% less likely to develop measles compared to the unvaccinated (aOR= 0.4; 95% CI=0.2,0.8). The odds of developing measles disease among individuals who visited a health facility since February prior to the outbreak were 4.4 times the odds in those who did not visit. (aOR = 4.4; 95% CI=1.4,14). The odds of developing measles disease in those who attended a public gathering were 4.9 times the odds in those who did not attend a public gathering (aOR = 4.9, 95% CI=2.01,12). The odds of developing measles disease in individuals who attended a place of worship were 19 times the odds in those who did not visit any place of worship (Table 2).

Measles Vaccine effectiveness

From the case-control analysis, 34% (27/80) of case-patients compared to 71% (57/80) 0f control-persons had received the measles vaccine at least once and this was 60% protective against measles disease (0.4 (0.2-0.8)). Therefore, the vaccine effectiveness was estimated at 60%.

Measles vaccination coverage

Approximately 71% (57/80) control-persons had received at least one dose of measles vaccine. The vaccine coverage was estimated at 71%.

Discussion

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Our investigation revealed an imported measles outbreak from Arua City, propagated by attending a public gathering, visiting a place of worship and visiting any health facility prior to the outbreak period. On the other hand, vaccination with measles-rubella (MR) vaccine was found to offer protection against acquisition of the disease among residents in Terego District.

The index case was from Leju TC and may have transmitted to many people there. The most affected age group was 0-6 months followed by 1-4 years and 7-11months, with 15+ years the least affected. This is because children 0-6 months have lower immunity compared to older age groups and largely depend on herd immunity from the vaccinated population. However, if the community has a low vaccination coverage, the population that are not eligible for vaccination are prone to getting the infections. Important to note that vaccination in Uganda is focused on children 9 months and above, since its known that the children 0-5 months are protected by maternal antibodies that continue to wane off as they mature, hence they largely depend on herd immunity from older children (11). The vaccine effectiveness was 60% in this investigation and the vaccine coverage was 71%. The coverage is lower than WHO recommended minimum target of 95%, which is required for herd immunity.
Children vaccinated against measles disease were 60% less likely to develop measles compared to the unvaccinated. Our findings are similar to those by Gressick et al, where MMR vaccinations offered substantial protection against measles disease(3). Immunization is the most effective way to reduce measles infections and transmission and measles vaccination was estimated to avert 57 million deaths globally, from 2000-2022 (12, 13).

Individuals who visited a health facility for health care services other than measles disease management since February 2024 were more likely to develop measles disease compared to those who did not go to any health facility in the same period. Measles is a highly contagious disease and will be highly spread from close contact in confined spaces with infected patients. Our findings coincide with other studies which show that healthcare settings are hot spots for measles transmission due to nosocomial spread of infectious agents to susceptible individuals in hospitals (14, 15). Attending a public gathering, and visiting a place of worship were associated with developing measles disease. People who attended a public gathering such as market, funeral, party were more likely to develop measles disease compared to their counterparts who did not. Similarly, people who went for prayers at places of worship were more likely to get measles disease compared to their counterparts who did not. Our findings are consistent with findings for a study in China and Uganda where high-density population propagated the spread of measles disease (6, 16). This is because during public gatherings and congregation, there is increased close contact between healthy and diseased people, hence easy transmission of the measles virus.

Study limitations
We used the control population from Leju Town council to calculate the vaccine coverage of the entire district since this was the most affected subcounty. However, this coverage may not be representative of the overall vaccine coverage in the district.

Conclusion
This was an imported outbreak from Arua City, propagated by low vaccination coverage, high density gatherings, and visiting hospital settings. The most affected age group was 0-6 months.
Public health actions
The District Task Force was activated on May 1, 2024 to respond to the outbreak.
We intensified measles surveillance through active case search at health facilities and communities. We sensitized political leaders and enhanced social mobilization and risk communication. The district health workforce intensified routine measles vaccination. A mass measles vaccination campaign was conducted targeting all children aged 6-59 months, in June 2024.

Recommendations
Routine measles vaccination targeting children from 6 months instead of 9 months, would increase herd immunity in the population.
Enhancing static measles vaccinations and outreaches by carrying out door to door vaccination outreaches would ensure no child is left behind.
Intensifying health education on child vaccinations during antenatal care services would increase maternal knowledge about vaccination.
Designating isolation facilities for sub-counties that have only HCIIs to enable isolation of patients with infectious diseases like measles would limit disease transmission during any gatherings.

Conflict of interests
The authors declare that they have no conflict of

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Acknowledgements
We appreciate the management of Terego District Local Government and Obofia HCII for their stewardship, and the community for their participation in this investigation. We also thank the Ministry of Health through Uganda National Expanded Program for Immunization (UNEPI) for their technical support. We are grateful to Global Alliance for Vaccines and Immunization (GAVI) and the US CDC for funding this investigation.

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ommended age for first dose of measles vaccine most affected in Kakumiro District, February–May 2024

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Summary

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 control and prevention 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 unmatched case-control to identify factors associated with measles transmission. We identified risk factors using conditional logistic regression. We inspected health centers, trading centers and households to further identify factors that facilitated the spread of measles. We estimated vaccine coverage and Vaccine Efficacy.

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 9m–≤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 crowded 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 efficacy was 65% (95%CI: 13%-91%). We observed crowdedness and lack of triaging/isolation in health facilities.

Conclusion
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 efficacy in the district.

Background
Measles remains a global public health challenge with an estimated 136,000 people dying from it in 2022 alone (1). Case fatality rates (CFRs) of measles range from 0.1% in developed countries to 15% in developing countries; and are highest among unvaccinated children under 5 years and lowest among vaccinated children regardless of their setting (1, 2). In 2019, data from the World Health Organization (WHO) showed that measles cases had risen by 300% globally and 700% in the African region (3). The disproportionate burden in Africa is compounded by influx of refugees, inadequate funds for immunization activities and reduced vaccine efficacy due to poor vaccine management and injection safety measures (4).

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Vaccination is one of the most effective ways to prevent measles and its spread in populations. It is estimated that vaccination succeverted globally, an estimated 57 million deaths between 2000–2022 and decreased measles deaths from an estimated 761,000 in 2000 to 136,000 in 2022 (5). Uganda offers 2 doses of measles-rubella (MR) as recommended by the WHO guidelines (1). The first dose (MR1) which was introduced in 1981 is given at 9 months and the second dose (MR2) only recently introduced in 2022 is given at 18 months. There was a noted improvement in the vaccine coverage (VC) for the single dose of measles containing vaccine in a 10 years period from 83% in 2013 to 93% in 2023 (6). The second dose on the contrary had a decrease in VC from 49% in 2022 to 21% in 2023 (6). To achieve herd immunity sufficient to prevent outbreaks, the WHO recommends a vaccination coverage of 95% for any antigen (1). However, the global vaccination coverage for the MR1 still stagnates at 86% and that of MR2 at 70%. Similarly, in Uganda, these vaccine coverages are lower than the recommended with MR1 coverage at 90% and MR2 at only 28% as of the third quarter financial year 2023/2024 (DHIS2 data). As of mid-year, 2024, eighteen districts countrywide had reported and confirmed measles outbreaks according to the Uganda Expanded Program on Immunization (UNEPI) third quarter, 2023/2024 financial year report. The outbreak in Kakumiro was notified to the Ministry of Health on April 7, 2024.

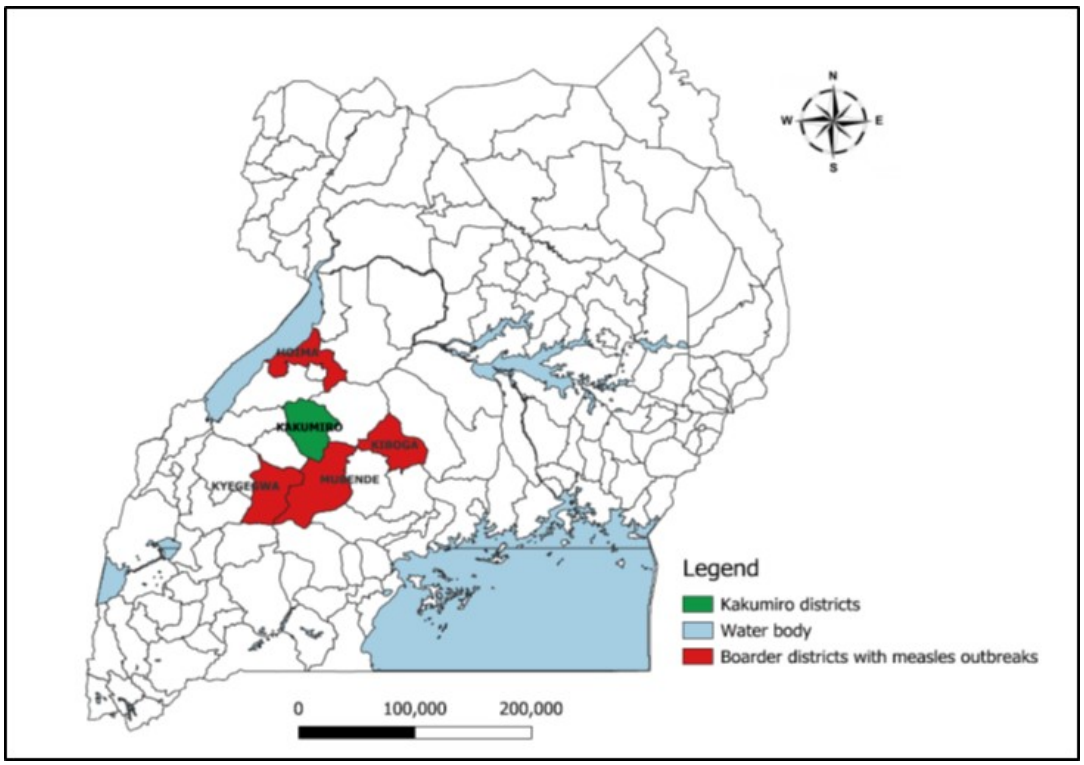

Figure 1: Location of Kakumiro District, Uganda

We investigated this outbreak to determine its scope, assess risk factors for disease transmission, assess vaccine coverage and effectiveness, and recommend evidenced-based control and prevention interventions.

Methods

Outbreak area

Kakumiro District is located in the western region of Uganda. Administratively, Kakumiro constitutes of 24 sub-counties with a population of approximately 651,200 people. About 333,200 are males and 318,000 females as of 2024. The MR vaccination coverage in, Kakumiro prior to the outbreak was 61% for MR1 and only 10% for MR2 (DHIS2, January 2024). Four of the five districts bordering Kakumiro had prior reported and responded to measles outbreaks including Hoima, Kyegegwa, Kiboga and Mubende districts (Figure 1).

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Case definition and finding
We defined a suspected case as onset of fever and maculopapular generalized rash with one or more of the following: cough, coryza or conjunctivitis in any resident of Kakumiro District from February 1 to May 30, 2024. A confirmed case was a suspected case with laboratory confirmation for measles IgM antibodies
We conducted active case search in both health facilities and communities. In health facilities, we reviewed health records including out-patient department (OPD) and in-patient department (IPD) registers. In the communities, with the help of village health teams (VHTs) and health assistants, we conducted house to house search and also found cases through snow balling. All the case-patients identified from both health facility and community active case searches were line listed and this was updated daily.

Descriptive epidemiology
We calculated the attack rates by person (age, sex) and place (subcounty) using projected population estimates from Uganda Bureau of Statistics (UBOS, 2024) as denominators per 100,000 persons (7). We used an epicurve to assess the distribution of measles cases by time of rash onset. A map was drawn to demonstrate the distribution of case-patients by place.

Environmental assessment
During the case-finding activities, we conducted onsite inspections of the health centers, trading centers and households in the outbreak area to observe the crowdedness and exposure risk behaviors among persons.

Laboratory investigations
This was already a confirmed outbreak. By the time of this investigation, blood samples from 16 suspected case-persons had been drawn for laboratory investigations. These investigations were conducted in the Uganda Virus Research Institute (UVRI) EPI laboratory. To declare a measles outbreak in Uganda, at least three out of five samples (60%) collected in an area in the same period must test positive for measles IgM.

Hypothesis generation

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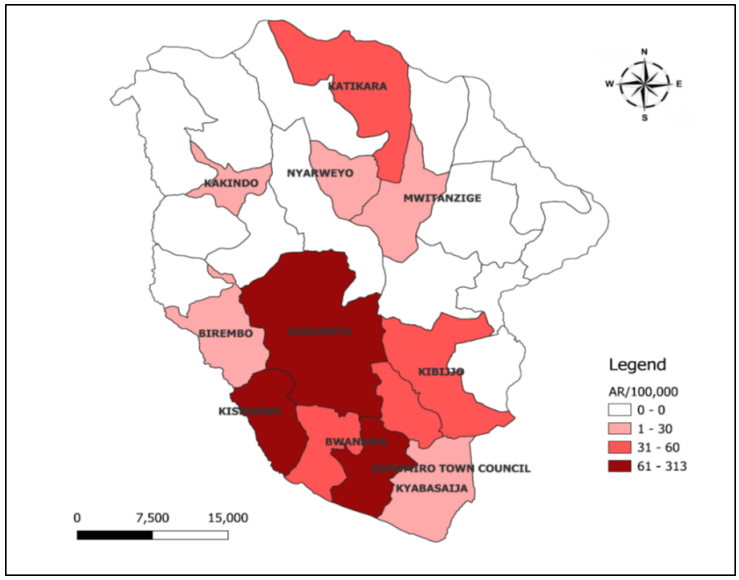
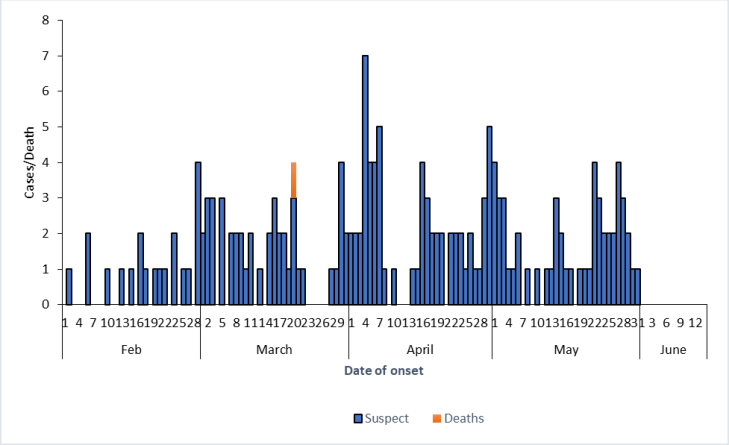


measles in attendance such as places of worship, schools, parties; visiting a health facility and visiting or receiving a visitor from outside the district. We generated hypotheses about potential exposures based on findings from both descriptive epidemiology analysis and hypothesis-generation interviews.



Case control investigation

We conducted an unmatched case-control study to test the hypotheses, in which we interviewed 100 cases and 100 controls. A control-person was a resident of Kakumiro with no history of fever and rash from February 1– May 30, 2024. Controls were selected from the same village and age category which was within +/- 3 years age difference as the case-patients. We used an interviewer administered questionnaire to interview case-patients and control-persons. We asked case-patients and control-persons about their vaccination status (checking the child's vaccination card or presence of vaccination scars for confirmation), travel history, receipt of visitors, exposure to measles case-patients including going to gatherings such as schools, water collection points, parties, health facilities with case-patients of measles. We used conditional logistic regression to identify factors associated with measles.

Vaccine effectiveness

We calculated 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.

Vaccine coverage

Vaccine coverage was estimated using the percentage of persons vaccinated among eligible controls.

Ethical considerations

This outbreak investigation was in response to a public health emergency and was therefore determined to be non-research. The Ministry of Health (MoH) gave permission to investigate this outbreak. In agreement with the International Guidelines for Ethical Review of Epidemiological Studies by the Council for International Organizations of Medical Sciences (1991) and the Office of the Associate Director for Science, US CDC/Uganda, it was determined that this activity was not human subject research and that its primary intent was public health practice or disease control activity (specifically, epidemic or endemic disease control activity). This activity was reviewed by the US CDC and was conducted consistent with applicable federal law and CDC policy. §§See, e.g., 45 C.F.R. part 46, 21

Variable	Cases n (%)	Controls n (%)	cOR (95%CI)	aOR (95%CI)
Traveled outside the district during exposure period				
No	97 (51)	94 (49)	Ref	
Yes	1 (14)	6 (87)	6.2* (0.7-52.4)	- -
Exposure to a measles case-patient in a school among school goers				
No	13 (65)	7 (35)	Ref	
Yes	5 (38)	6 (62)	3* (0.7-12.6)	- -
Exposure to a measles case-patient in the neighborhood				
No	59 (52)	55 (48)	Ref	
Yes	41 (48)	45 (52)	1.2 (0.7-2.1)	- -
Never received any MR vaccination				
Yes	62 (45)	76 (55)	Ref	Ref
No	21 (68)	10 (32)	2.6 (1.1-5.9)	2.9 (1.1-7.6)
Exposure to a measles case-patient in a crowded health facility during exposure period				
No	56 (37)	97 (63)	Ref	Ref
Yes	44 (94)	3 (6)	25 (7.5-86) *	47 (6.09-369) *
Exposure to a measles case-patient in the same household during exposure period				
No	58 (38)	95 (62)	Ref	Ref
Yes	42 (89)	5 (10)	14 (5.1-37) *	9.3 (2.9-30) *
Received a visitor in the household during exposure period				
No	90 (48)	99 (52)	Ref	Ref
Yes	10 (91)	1 (9.1)	11 (1.4-88) *	4.2 (0.3-54) *

* Fishers exact test

C.F.R. part 56; 42 U.S.C. §241(d); 5 U.S.C. §552a; 44 U.S.C. §3501 et seq. All experimental protocols were approved by the US CDC human subjects re-

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view board (The National Institute for Occupational Safety and Health Institutional Review Board) and the Uganda Ministry of Health and were performed in accordance with the Declaration of Helsinki.

Results

Descriptive epidemiology

We identified 188 cases of which 6 were confirmed and one died. The overall attack rate was 67/100,000. Medium age was 3 years (IQR: 1.0, 8.5 years). Children <9 months (AR=232/100,000) and those aged 9 months–≤5 years (AR=177/100,000) were the most affected. The majority (75.3%) of case-patients had received at least one dose of MR vaccine. Eleven out of 24 (46%) subcounties were affected. The most affected subcounties were Kisengwe (AR=313/100,000), Kasambya (AR=126/100,000), and Kakumiro town council (AR=110/100,00) (Figure 2).
All the 188 cases (100%) had presented with fever and a rash, 175 (93%) had coryza, 124 (66%) had conjunctivitis, and only 51(27%) had developed cough. This was a propagated measles outbreak that lasted for about 120 days spanning from February 2 to May 30, 2024. However, no new cases were identified in two incubation periods (Figure 3).

Figure 2: Attack rates by subcounty during an outbreak of measles, Kakumiro District, February–May, 2024

This was a propagated measles outbreak that lasted for about 120 days spanning from February 2 to May 30, 2024. However, no new cases were identified in two incubation periods (Figure 3).
Figure 3: Distribution of cases of measles by time during a measles outbreak, Kakumiro District, February–May, 2024

Environmental assessment findings

We observed crowding at health facility OPDs and pediatric IPDs with no form of triage or isolation for measles case-persons in place. At community level, we also observed crowding in gatherings such as churches, markets, and trading centers. Healthy children freely interacted with case-persons having active measles infections.

Hypothesis generation findings

Of the 50 case-patients interviewed for hypothesis generaion,40 (80%) were attending school, 38 (76%) lived in household with > 5 occupants, 29 (58%) reported to always spend >15 minutes at water collection points, 20 (40%) had visited a health facility during exposure period,7 (14%) had not received any measles containing vaccine, 6 (12%) had received visitors in their households during exposure period, and 5 (10%) had travelled outside Kakumiro district.

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trict, February–May, 2024

Twenty-one (68%) case patients and 10 (32%) control-persons had never received any MR vaccine (aOR=2.9, 95%CI: 1.1-7.6). Forty-four (93.6%) case-patients and 3 (6.4%) control-persons were exposure to a measles case-patient in a crowded health facility during exposure period (aOR=47, 95%CI: 6.09-369). Forty-two (89.4%%) case-patients and 5 (10.6%) control-persons were exposure to measles case-patient in the same household during exposure period (aOR=9.3, 95% CI: 2.9-30) (Table 1).

Table 1: Risk factors for infection and transmission among case-patients during an outbreak of measles, Kakumiro District, February –May, 2024

Discussion

Our investigation identified risk factors for transmission of measles as non-vaccination for measles, exposure to a measles case-patient in a crowded health facility during exposure period and exposure to measles case-patient in the same household during exposure period. Children below 9 months and those aged 9m–≤5 years) were the most affected. Vaccine coverage was 88% and vaccine efficacy was 65%.

Non-vaccination for measles was associated with measles infection in this outbreak. Similar findings have been reported in several other outbreak studies in Uganda and other settings (8, 9, 10). Vaccination has been documented to have a protective role in reducing the acquisition, transmission and development of complications from a measles infection (1, 2).

Exposure to or being in close contact with an infected person in crowded health facilities or households propagated this outbreak. These findings are similar to those in a study conducted in Mayuge district in 2016 (11). Measles is one of the world's most contagious disease, spread by contact with infected nasal or throat secretions (coughing or sneezing) (12). One infected person can transmit the virus to 9 out of 10 unvaccinated persons who get into close contact with his/her infected nasal or throat secretions (12). Measles can be transmitted by an infected person from four days prior to the onset of the rash to four days after the rash erupts (2). The virus can stay active and contagious in the air or on infected surfaces for up to two hours (2, 3).

We reported a case fatality rate much lower (0.5%) than that reported in a study conducted in Kyegegwa that reported a CFR of 16% and one in Lyantonde district which reported a CFR of 4.9% (9, 14). This could be related to the higher MR vaccine coverage including uptake of the recently introduced second MR dose among cases in our study as compared to that in these studies which could have reduced the risk of death among cases. However, globally this CFR is within the documented range of 0.1% to 15% (1, 2).

Children below 5 years of age were more affected compared to those above 5 years with the most affected in this age category being children <9 months. This was comparable to findings from other studies conducted in Uganda in the previous years (6, 11, 12). The findings are also plausible in areas where vaccination coverage is low and under situations of crowding, both which were observed in this investigation (12,16). Higher attack rates among children <9 months of age, an age group below the recommended age for the first dose of a measles containing vaccine demonstrates weaning of the passively transferred maternal antimeasles antibodies from the infants (16). These antibodies wean off between 5 and 11 months of age (16).

The coverage (88%) for a single dose of MR estimated in this study, is lower than the >95% recommendation to achieve herd immunity in a community (1). However, it was comparatively higher than what was reported in studies conducted in Kamwenge district as 75% in 2015, Mayuge district as 68% in 2016 and Lyantonde as 76% in 2017(9, 11, 15). The high coverage could be due to availability of the second dose of MR now as compared to when the other studies were conducted, which has increased the coverage of ≥1 dose (s) of MR among children below 5 years.

Our study estimated vaccine efficacy at 65%, this was lower than what other studies within the country had estimated including in Kamwenge district which had estimated 64% 74% in Mayuge district but in Lyantonde district (9, 11, 15). Several factors influence vaccine efficacy including vaccine quality, number of doses administered, cold-chain failure, and other host factor (16).

Study limitations

There could have been misclassification bias in the selection of controls since none was tested for IgM to rule out incubation of the virus. This could have skewed our findings in the risk factors for transmission of the infection. However, we mitigated this by following a stringent inclusion criterion guided by the

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case definition. We did not verify every vaccination status reported by checking the immunization cards since others reported having lost or not having them, this could have slightly skewed the estimated vaccination coverage and efficacy. However, we made attempts to verify reported vaccination statuses without cards by checking for a vaccination scar on the left upper arm of the children. We relied on recall of care givers and case-patients to answer most questions and these could have led to some form of recall bias. However, we probed with key events and situations to aid recall.

Conclusion

This measles outbreak was associated with non-vaccination for measles, exposure to a measles case-patient in crowded health facilities and household during exposure period. Children below the recommended age for the first dose of measles containing vaccine were the most affect and the estimated vaccine efficacy in the affected communities was suboptimal.

Recommendations

We recommended to MoH to conduct a supplementary immunization activity targeting children ≥6 months. This was done 2 weeks later. 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 efficacy in the district.

Conflict of interest

The authors declare no competing interests

Authors' Contributions

EOO conceptualized the study idea, collected data, analyzed it, and wrote made the manuscript. PK, JN, PEO conceptualized the study idea, collected data and reviewed the bulletin. IA, RM, BK, DK and ARA supported in editing, and reviewing of the bulletin to ensure scientific integrity. All authors read and approved the final bulletin.

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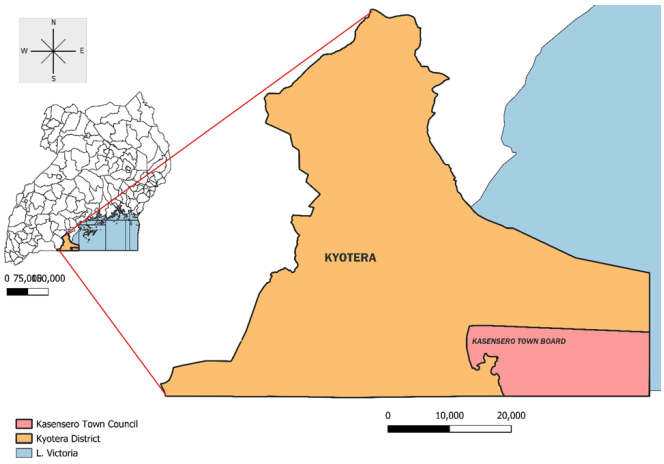

Cholera outbreak associated with consumption of contaminated lake water at Kasensero landing site, Kyotera District, April–May 2024

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Summary

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

Methods
We defined a suspected case as the onset of watery diarrhoea in a resident (aged ≥2 years) of 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 active case search in the community with the help of local leaders. We conducted descriptive epidemiology and environmental assessment to generate a hypothesis. We conducted an unmatched case-control study and identified risk factors using logistic regression.

Results
We identified 64 cases (9 confirmed and 55 suspected) with an attack rate (AR) of 12/1,000 and a case fatality rate of 3% (2/64). The median age was 35 (IQR: 27-42 years). Males (AR=12.5/1000) and females (AR=11.4/1000) were similarly affected. Kimwanyi parish was the most affected parish with 44 cases (AR=45/1,000). We observed latrines with compromised sub-structures, open defecation, and flooding at the landing site. There was general contamination of the lake water caused by the rains and flooding. The floating vegetation on the lake resulted in the stagnation of the lake water. This could have sustained contamination of lake water which is the main source of livelihood at the landing site. The use of lake water for domestic purposes was significantly associated with cholera (aOR=4.0; 95% CI: 1.8–8.6). Boiling drinking water (aOR=0.4; 95% CI: 0.2–0.8) was protective.

Conclusions
The outbreak was associated with drinking unboiled/untreated lake water contaminated by faecal matter and stagnated by floating vegetation. We recommended boiling or treating lake water and construction of recommended pit latrines at the landing site.

Introduction

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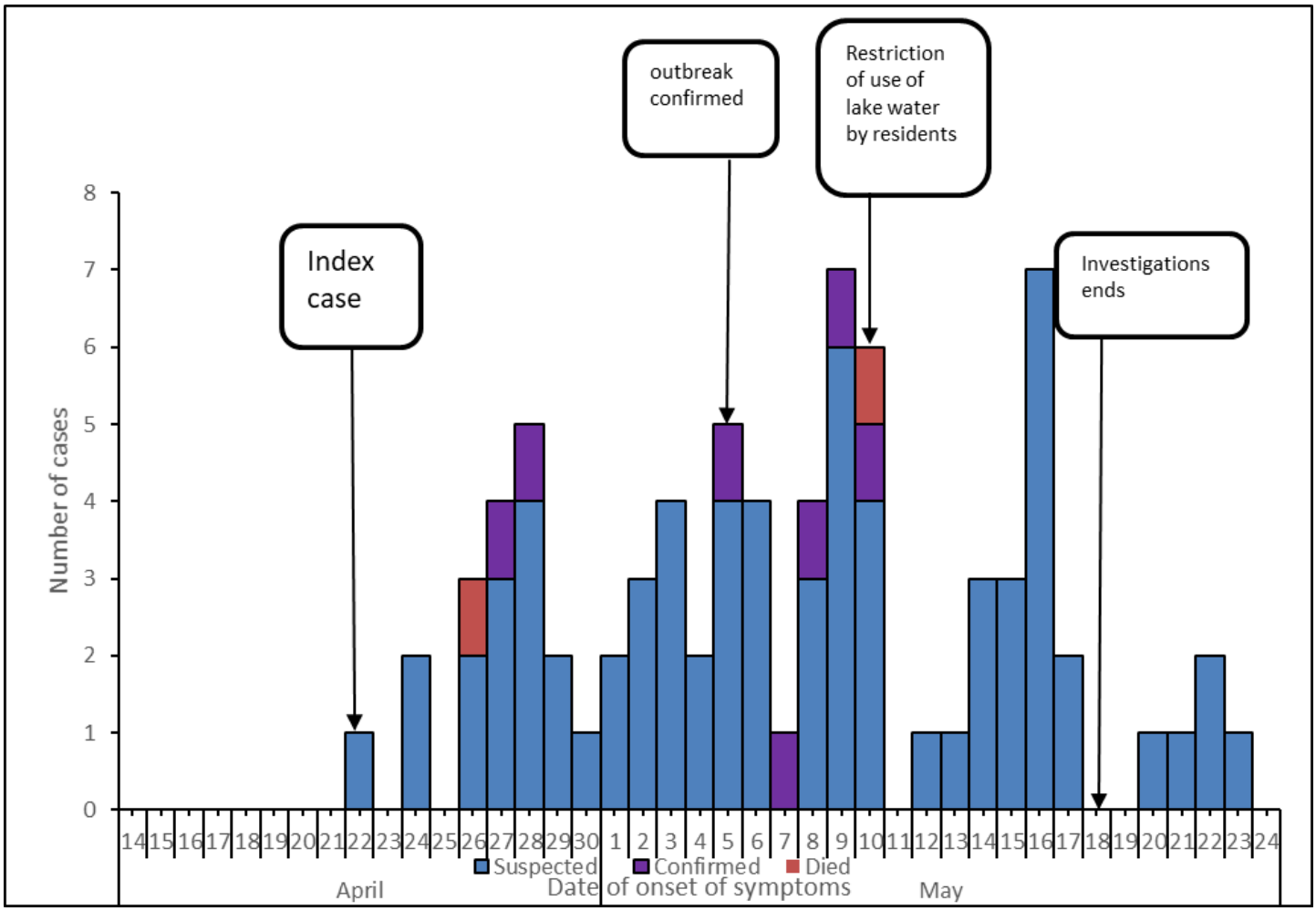
Over 1.3 billion people are at risk of cholera in endemic countries (1). The disease still affects at least 47 countries across the globe, resulting in an estimated 2.9 million cases and 95,000 deaths per year worldwide (1, 2). Sub-Saharan Africa accounts for 60% of the global burden of cholera (1). In Uganda, 11,030 cases of cholera were reported during the 2011 – 2016 period through the Ministry of Health, Health Management Information System disease surveillance data base (3).

Cholera is a preventable and treatable acute diarrhoeal disease caused by infection of the intestine with the bacterium *Vibrio cholerae*, either serogroup 01 or 0139 (4, 5). It is usually transmitted through consumption of water or food contaminated by faeces containing *Vibrio cholerae* (6). It remains a major public health threat in communities with poor sanitation and limited access to safe water for domestic use. It is common in congested settlements such as landing sites and refugee camps. Cholera affects all age groups. About 20% of those infected develop acute, watery diarrhoea and 10-20% of these develop severe dehydration. The incubation period is short (2 hours to 5 days), thus creating an opportunity for quick raise in cases. The case fatality rate (CFR) among untreated cases may reach 30-50%, while it can go as low as less than 1% with appropriate management. Recommended treatment for Cholera is rehydration and appropriate antibiotics since they reduce the shedding of bacteria



and reduce the duration of infection.

A cholera outbreak is defined by the occurrence of at least one confirmed case of cholera and evidence of local transmission (2). The first cholera outbreak in Uganda occurred in 1971, and several cholera cases have been reported since then (7-11). In areas with sustained (year – round) cholera transmission, outbreaks are defined as an unexpected increase (in magnitude or timing) of suspected cases over two consecutive weeks of which some are laboratory confirmed (2).

On 26th April 2024, Kyotera District received an alert from Kasensero Health Centre II regarding the death of a fisherman from severe dehydration one day after returning from a fishing trip. He had suddenly developed vomiting and acute watery diarrhoea while fishing, and was returned by his colleague

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severely prostrated. An increased number of cases of acute watery diarrhoea were also reported in the community. On 5th May, 2024, stool culture and sensitivity results from the Central Public Health Laboratories confirmed *Vibrio cholerae*. Kasensero landing site had last reported a cholera case over twenty years ago. We determined the source of the outbreak, its magnitude, and risk factors to inform control and prevention measures.

Methods

Outbreak area

The outbreak occurred at Kasensero landing site, which is located on the western shore of Lake Victoria, in Kyotera District, South Central Uganda (Figure 1). It is located a short distance from the Uganda border with Tanzania, with 60% of the population either being Tanzanian or having roots in Tanzania. It is a Point of Entry through which traders, fishermen, and travellers from East African countries access Uganda. The main economic activity in the area is fishing. The landing site has a population of approximately 5,000 inhabitants.

It has five parishes (wards) and eleven villages (cells). It is located next to Kyeebe sub-county, all in Kakuuto county.

Figure 1: Location of Kasensero landing site

Case definition and finding

We defined a suspected case as onset of watery diarrhoea in a resident (aged ≥2 years) of the Kasensero landing site, Kyotera district from 1 April to 24 May 2024. A confirmed case was defined as a suspected case with a positive culture for *V. Cholerae* from a stool sample. Cases were identified through health facility records review and active case search in the community with the help of local leaders.

Descriptive epidemiology

We conducted a descriptive analysis of the cases identified by age, sex, clinical presentation, place of residence, and possible risk factors. We calculated attack rates by place (parish) and sex using the 2014 population estimates obtained from the Kyotera district Biostatistician. An epidemiological curve was used to describe the distribution of cases by dates of symptom on set.

Laboratory investigations

We collected stool samples from 38 suspected cases for laboratory confirmation.

Exposure	Exposure	Cases n (%)	Controls n (%)	cOR (95% CI)	aOR (95% CI)
Source of water for domestic use	Others (tap water and rain water)	20 (44)	170 56	Ref	Ref
	Lake water	40 (28)	50 47	2.8 (1.5-5.4)	4.0 (1.8-8.6)
Using a toilet in a home	No	51 (40)	77 60	Ref	Ref
	Yes	09 (18)	40 82	0.3 (0.15-0.8)	0.3 (0.1-0.7)
Preparation of drinking water	Others (leave to settle, filtered)	22 (44)	28 56	Ref	Ref
	Boiling	25 (22)	89 78	0.4(0.2-0.7)	0.4(0.2-0.8)

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30 cases using a case investigation form to collect information on potential risk factors including sources of water, drinking water preparation practices, presence of a latrine at home, travel outside the place of residence, and food storage practices.

Case-control study

We conducted an unmatched case-control study to test the hypothesis, in which we interviewed 60 cases and 120 controls. We defined a control as a resident of Kasensero landing site, aged ≥ 2 years with no history of acute watery diarrhoea from 1 April 20204 to 24 May 2024. Controls were randomly selected, focusing on Kimwanyi parish, which was the most affected parish. We administered a standard questionnaire to both cases and controls. We asked about their sources of drinking water, water for domestic use, food last eaten, methods of water preparation before drinking, storage of water and food, use of latrines/toilets and history of travel. We used logistic regression to identify factors associated with cholera transmission.

Ethical considerations

This investigation was in response to a cholera outbreak. The Ministry of Health of Uganda gave the directive to investigate this outbreak. The Office of the Associate Director for Science at the Center for Disease Control and Prevention (CDC) Uganda determined that this research did not involve human subject research and that its primary intent was public health practice or disease control. Verbal informed consent was obtained from participants or, if the interviewee was a minor, guardians before the start of each interview.

Results

Descriptive epidemiology

We identified 64 cases (9 confirmed cases and 55 suspected) with an attack rate (AR) of 12/1,000. There were two deaths: case fatality rate (CFR=3%). The median age was 35 (IQR: 27-42 years). Males (AR=12.5/1000) and females (AR=11.4/1000) were similarly affected. Kimwanyi Parish was the most affected parish with an attack rate of 42.2/1,000. Attack rates for the other parishes were as follows; Central A (4.3/1,000), Central B (9/1,000), Kagera A (2.6/1,000), Kagera B (2.9/1,000).

Figure 2: Distribution of cholera cases by date of onset of symptoms at Kasensero landing site, April – May 2024

The epidemic curve shows that after the onset of the disease on April 22, a point source outbreak occurred up to April 28, followed by continuous community transmission for three weeks. There were four peaks during the outbreak; the last two higher than the first two. The final peak occurred on May 16, followed by a sharp decline to one or no cases per day until the outbreak ended (Figure 2).

Environmental findings

There was a piped water system that runs from Sekaningo to Kasensero town, and exists under the Central Umbrella of Water and Sanitation Authority under the Ministry of Water and Environment. It covered parts of the most affected village, cell 5. One water point was damaged following the flooding leading to damage to the pipeline extension to the point. A new water point was not set up to replace the abandoned one. The number of water points in use and accessible could not be established. Some households were fetching water from the lake for domestic use. There was one public toilet (3 stances for women and 3 stances for men) available constructed by the town council and managed by a service provider at a fee of UGX 200 per use. There were at least 6 household latrines (raised and drainable). The water table is very high and limits depth of pit latrines leading to the option of using raised latrines which are expensive. All the household latrines reviewed were old and very likely to have leaking chambers to the ground water due to structural integrity of the latrine sub structure.

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The area was flooded as the water levels had risen, and entered some houses close to the lakeshore. With limited access to latrine use due to distance or lack of household latrine or inability to pay the convenience fee, there were reported cases of open defaecation. We also found human faeces in the community and in the flooded water. There was floating water vegetation causing stagnation of contaminated water from the community at the lake shore.

Hypothesis generation

Out of 30 cases, 16 (53%), depended on lake water for domestic use, 29 (93%) did not have a pit latrine at home, and only 5 (17%) had travelled outside Kasensero within two weeks before the onset of the disease. Based on the results of the descriptive analysis, we hypothesized that the outbreak was associated with the consumption of contaminated and untreated Lake Victoria water by residents at Kasensero landing site.

Case-control study results

Residents who collected their water from the lake were four times more likely to develop cholera compared to those who collected their water from other sources like taps or rainwater (aOR = 4.0, 95% CI: 1.8 – 8.6). Additionally, those who boiled their drinking water were 60% less likely to develop cholera (aOR = 0.4 CI: O.2 – 0.8) (Table 1).

Table 1: Risk factors for cholera among residents of Kasensero landing site, Kyotera District, April–May 2024

Discussion

This cholera outbreak was associated with drinking contaminated unboiled/untreated lake water. The source of *V. cholerae* in this outbreak was not determined. The landing site had recently experienced heavy rainfall, and there was flooding of the area. Additionally, there was floating vegetation for the duration of the outbreak, along the lake shores. This vegetation caused stagnation of the lake water that was contaminated from the community. The residents collected contaminated lake water near the lake shore and drank it without treating it causing the outbreak.

Previous outbreaks in Uganda and other African countries have also been associated with drinking contaminated lake water (10, 13). Landing sites and town slums are among the major outbreak prone areas in the country (10). Other cholera outbreaks in Africa have been associated with drinking contaminated river water, eating at large gatherings, and eating left over food (11, 14, 15).

Study limitations

We were not able to identify how the index case acquired the infection to prevent outbreaks.

Conclusion

This outbreak was associated with consumption of contaminated lake water, stagnated by floating vegetation. The water was likely contaminated by introduction of faeces through practices like open defecation. To prevent future similar outbreaks, we recommended construction of more taps to ensure access to safe water by the landing site residents, construction of pit latrines adequate for the high-water level at the landing site by the local authorities, and subsiding fees for access to the public toilets.

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cost. Health care workers were trained on Infection Prevention and Control practices (IPC) and case management; they were also trained on local preparation of Oral Rehydration Salts (ORS).

Recommendations

In the short term, we recommended review of access to the public toilet by the local authorities through suspension or subsidizing the user fees. We also recommend that the government, in partnership with the local authorities provide free safe water at the landing site since only a few taps were available and most of the residents were not able to afford the cost daily. In the long term, we recommend construction of more toilets at the landing site since most residents cannot afford to construct the recommended toilets due to the high -water tables. The government in partnership with the local authorities should also engage the water department and the umbrella scheme responsible for the tap water supply in the area to review the requirements for new applicants and reduce the associated cost.

Conflict of interest

The authors declare that they have no conflict of interest.

Authors' contributions

BA, EM, and JOK designed the study and contributed to data collection and analysis. TR, SM, and JG also contributed to the study design and data collection. BA led the writing of the bulletin. TR, SM, PEO, RM, BK, and ARA participated in the writing of the bulletin and review to ensure scientific integrity. All authors contributed to the final draft of the bulletin.

Acknowledgments

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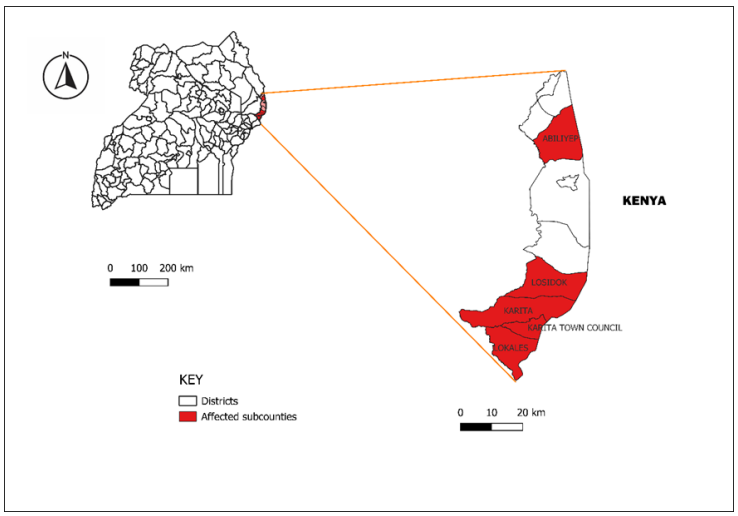

Anthrax outbreak associated with sleeping on the hides of cattle that died suddenly in Amudat District, Uganda, Dec 2023–Jun 2024

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Summary

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 and prevention measures.

Methods

Continues to page 52

house-to-house search and patient record reviews. Human and animal samples were collected and tested, alongside an environmental assessment. We conducted an unmatched control 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). 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.

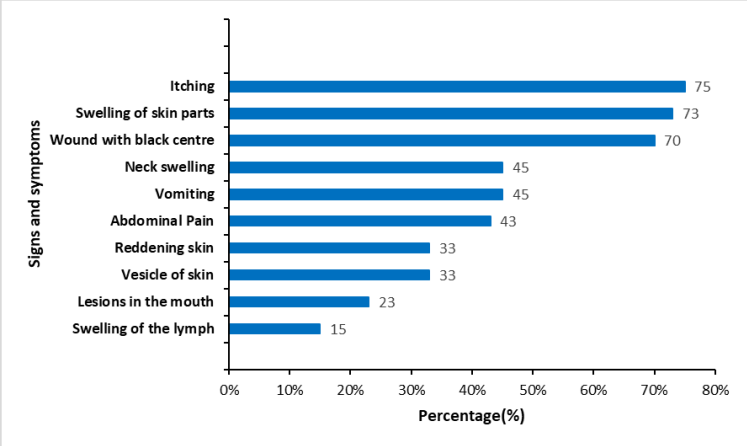
Conclusion

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.

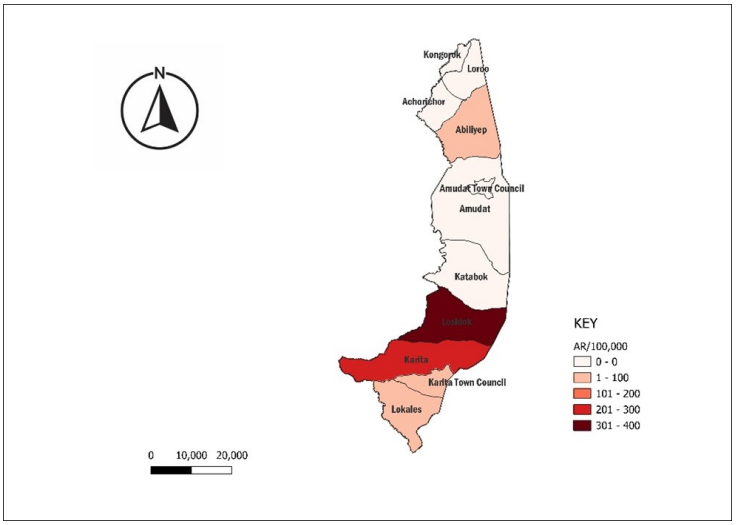
Introduction

Anthrax, caused by *Bacillus anthracis*, is a zoonotic disease affecting both humans and animals(1). The bacterium, an aerobic, spore-forming Gram-positive organism, enters animal hosts through grazing in contaminated areas or consuming tainted feeds. Once ingested, the spores germinate into active bacteria, causing illness(1). Humans typically contract anthrax from contact with infected livestock and their animal products, such as skin, meat, hides, and bones. Anthrax manifests in three primary forms in humans cutaneous, gastrointestinal, and inhalational—each with varying routes of exposure and different incubation periods: 2–7 days for cutaneous, 1–6 days for inhalational, and 1–6 days for gastrointestinal (2).

Cutaneous anthrax is the most frequently reported form in humans, accounting for up to 95% of cases with an untreated fatality rate as high as 20% (3,4). Globally, anthrax results in an estimated 20,000 to 100,000 cases annually, predominantly affecting impoverished rural areas (4), notably in African and Asian countries (5). The World Health Organization classifies anthrax among neglected zoonotic diseases that perpetuate poverty by impacting health and livelihoods(4).



Uganda, characterized by its diverse biodiversity and growing population, experiences frequent interactions between humans and animals, heightening the risk of zoonotic diseases(6). Between January 2017 and April 2023, Uganda documented 19 anthrax outbreaks (7) including notable occurrences in districts like Zombo, Arua, Kween, and Kiruhura in 2018(8). During this period, surveillance data recorded 186 human and 721 livestock deaths attributed to anthrax (9).



In December 28, 2023, Amudat District reported its initial suspected anthrax case involving a 10-year-old boy from Kakworobu Village. Symptoms included diarrhea, body weakness, and eschar on the shoulders after the child participated in handling and consuming meat from a cow that died suddenly. Subsequent sporadic cases emerged in early 2024, prompting Karita Health Center IV to notify district authorities of suspected anthrax cases by February 5, 2024. Following positive test results from human samples collected on March 15, 2024, the Ministry

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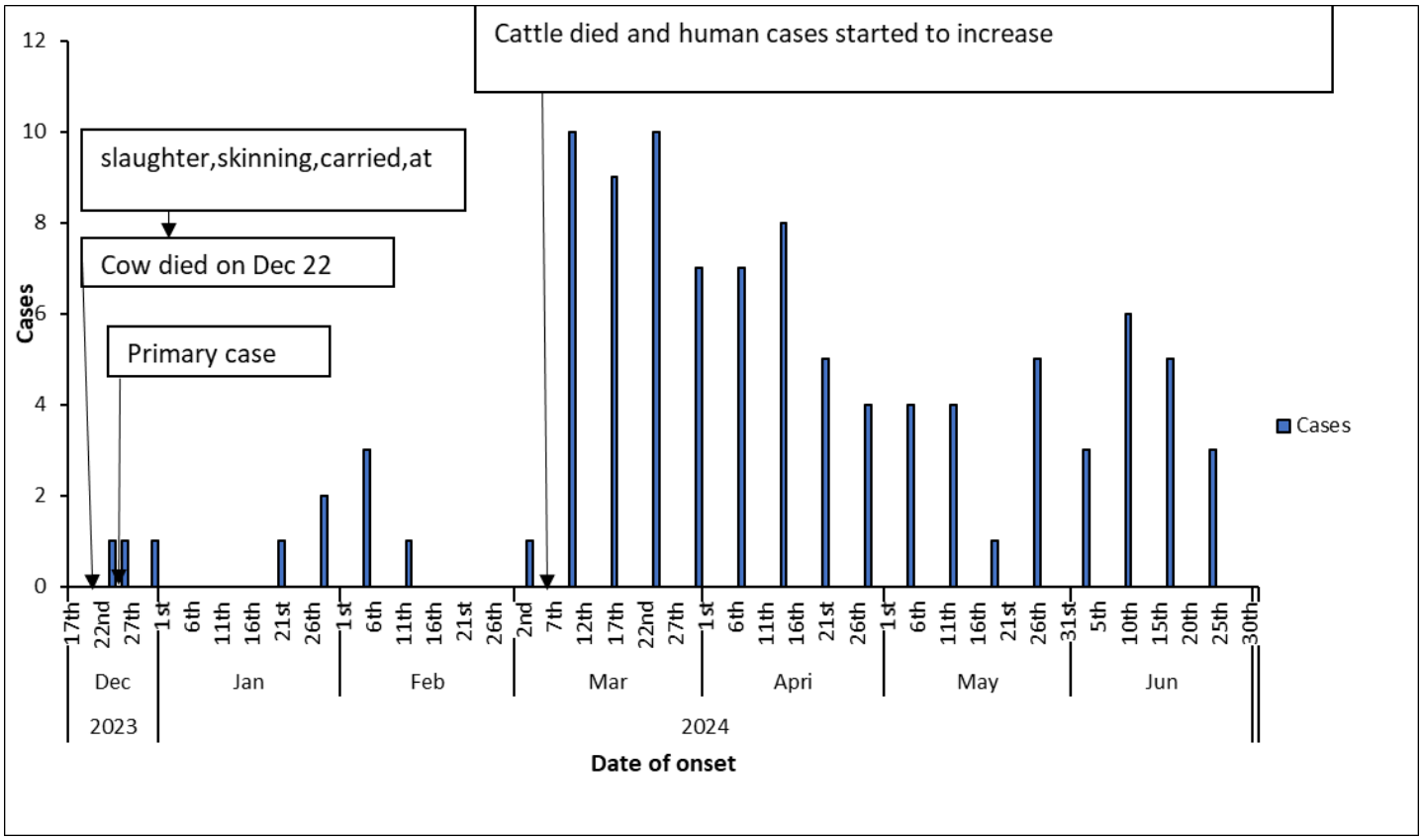

of

Health intervened to support the district in investigating the outbreak. We investigated to identify the outbreak's origin, assess exposure risks, and recommend evidence-based control and prevention measures.

Methods

Outbreak setting

Amudat District is located in north-eastern Uganda, in the Karamoja sub-region. It borders Kenya to the east, Moroto District to the north, Nakapiripirit District to the west, and Kween and Bukwo Districts to the south and borders Pian Upe Wild Wildlife Reserve. The district has ten (10) sub countries including: Amudat Town Council, Loroo, Karita Town Council, Abiliyep, Katabok, Karita, Kangorok, Lokales, Losidok, and Achorichori (Figure 1). The district has a population of approximately 157,800 (Uganda Bureau of Statistics) The people are predominantly nomadic pastoralists. Notably, the district reported its first outbreak.

Figure 1: Location of affected sub counties in Amudat District, Uganda

Case definition and finding

We defined a suspected case as follows: cutaneous anthrax: Acute onset of skin lesions (vesicle or eschar) plus ≥2 of skin itching, reddening, and swelling, or skin lesions (vesicle or eschar) plus regional lymphadenopathy that occurred in a resident of Amudat District from December 2023 to June 2024.

A confirmed case was defined as a suspected case-patient with laboratory confirmation of *Bacillus anthracis* from a clinical sample.

To identify cases, we reviewed health facility records and conducted an active case search in the community with the help of the Village Health Team members (VHTs). We also constructed and updated a line list for this purpose.

Descriptive epidemiology

We described case patient were described by time, place, and person. An epidemic curve was devel-

Continues to page 54

A total of 24 samples (16 from humans; six from animals; and two soil samples) were collected and transferred to the testing laboratory using the hub system. Anthrax confirmation was based on the

	Number of participants			
Exposures	**Cases (%)**	**Control (%)**	**cOR (95%, CI**	**aOR (95%, CI**
Age				
< 5 years	6(30)	3(15)	Ref	
5-20 years	14(70)	17(85)	2.4(0.4-17)	3.7(1.2-11)
> 20 years	20(77)	100(97)	10(1.9-65)	20.1(3.3-121)
Sex				
Male	24(60)	55(46)	1.8(0.9-3.7)	
Female	16(40)	66(54)	Ref	
Contact with the hide				
Yes	24(60)	32(27)	4.1(1.9-8.7)	
No	16(40)	88(73)	Ref	
Dug-out animal remains				
Yes	13(32.5)	21(17.5)	2.3(1.0-5.1)	
No	27(67.5)	99(82.5)	Ref	
Sleeping on the hide of a dead cattle				
Yes	12(30)	3(2.5)	16.7(4.0-96)	11(2.6-47)
No	28(70)	117(97.5)	Ref	
Skinning of the cattle				
Yes	13(32.5)	10(14.4)	5.3(2.1-13)	
No	27(67.5)	110(85.6)	Ref	
Participated in slaughtering				
Yes	33(82.5)	41(34.2)	9.1(3.7- 22)	7.6 (2.1-28)
No	7(17.5)	79(65.8)	Ref	

identification of *Bacillus anthracis* by real-time PCR assay.

Environmental investigations

We inspected the grazing area in Losidok Sub-county following reports from residents who indicated that they had disposed of the carcasses of cattle that had died suddenly to assess potential sources of contamination and understand the impact on the environment.

Hypothesis generation

To generate hypotheses, we conducted interviews with the six suspected cases and three confirmed cases to identify possible sources and factors associated with contracting anthrax including: participating in slaughtering animals that had died suddenly, sleeping on the hides of these animals, digging up animal remains during cultivation, and direct contact with deceased animals that had died suddenly.

Case-control study

We conducted a 1:3 unmatched case-control study to identify risk factors for anthrax infection. All confirmed and suspect cases from December 2023 onwards were enrolled. A control person was an individual who never had any signs of cutaneous anthrax from December, 2023 to the time of the in-

Continued from page 54

vestigation, resident in the same village as the case-patient or the nearest household

Category	S	SC	SS	SCS	Sick	Total	OR(95%CI)
0	-	-	-	-	7	86	Ref
1	+	-	-	-	17	45	5.3(1.9-15)
2	+	+	-	-	3	6	13(2.2-78)
3	+	+	+	-	10	18	8.1(2.1-31)
4	+	+	+	+	3	5	19(2.6-136)

of a case and were screened for the clinical signs and symptoms before consideration.

Crude odds ratios (OR) were computed at the bivariate level using Chi-Square to assess associations between variables. Variables showing significance were subsequently included in a multivariate logistic regression model to obtain adjusted odds ratios. For small sample sizes where any cell in a 2x2 contingency table contained less than 5 observations, Fisher's exact test was employed to ensure robustness and accuracy in statistical inference. Variables with a 95% confidence interval (CI) that excluded one or $p < 0.05$ were considered significant.

Ethical considerations

This investigation was initiated in response to a public health emergency. The Ministry of Health (MOH) authorized the investigation and the Centre for Global Health at the US Centers for Disease Control and Prevention (CDC) classified the activity as non-human research, focusing on improving public health practices and disease control. We obtained permission from the leadership of Amudat District Local Government to conduct the investigation. Respondents were informed that their participation was voluntary and that they could withdraw at any time without any negative consequences. To ensure confidentiality, the respondents were interviewed in privacy.

Results

Descriptive epidemiology

We identified 102 case patients, of which 40 were confirmed and none died. The overall attack rate was 167/100,000 population. All the cases were cutaneous. The mean age of the 40 case patients was 24 years (range 7 months–70 years). The most affected age group was 5-20 years (attack rate: 206/100,000population), while the least affected was below 5 years age group (attack rate: 132/ 100,000population). Males constituted 63(62%) of the cases and had a higher attack rate (201/100,000 population) compared to females (132 /100,000 population). Losidok Subcounty had the highest attack rate (350/ 100,000 population), whereas Abiliyep Subcounty had the lowest attack rate (8/100,000 population). Itching (75%), swelling of skin parts (73%), and wounds with black centre (70%) were the most common signs and symptoms of illness (Figure 2).

Figure 2: Distribution of clinical symptoms of anthrax case patients during an anthrax outbreak, Amudat District, December 2023-June 2024

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As of the end of May 2024, a total of five sub-counties had been affected by the anthrax outbreak including Losidok, Lokales, Karita Town Council, Karita, and Abiliyep. Losidok Subcounty had the highest attack rate (350/ 100,000 population), whereas Abiliyep Subcounty had the lowest attack rate (8/100,000 population) (Figure 3)

Figure 3: Attack rate of affected sub counties during anthrax outbreak in Amudat District, December 2023-June 2024

Following the sudden death of a cow and subsequent handling and consumption of its meat on December 28, 2023, anthrax cases began to emerge. The incidence escalated over the subsequent months, reaching its peak in March 2024 with 37 cases. During this period, cattle returned from Kween District, where many animals died and were subsequently slaughtered. The meat from these carcasses was widely consumed, since in the culture of Pokots, they don't discard meat of animals that die. The epidemiological curve suggests multiple sources (Figure 4).

Figure 4: Distribution of a cases by the date of onset of symptoms during anthrax outbreak, Amudat district, December 2023 – June 2024

Laboratory findings
All the soil samples tested negative for *bacillus anthracis*.

Environmental assessment findings
We found scattered bones that indicated the previous disposal of cattle carcasses. We also came across discarded hides, which appeared to have been used as bedding and were found near residential areas.

Hypothesis generation
We interviewed 9 individuals in the community to obtain information about the likely exposures: 89% of respondents reported direct contact with animals that died suddenly, while 44% admitted to sleeping on the hides. Additionally, 22% of respondents mentioned involvement in digging up animal remains during cultivation. We therefore hypothesized that sleeping on cattle hides and slaughtering of cattle that died suddenly may be associated with the anthrax outbreak in Amudat District.

Case–control study findings
Residents who slept on the hide of the cattle that had died suddenly were 11 times more likely to contract cutaneous anthrax compared to those who did not (adjusted odds ratio (aOR = 11, 95% CI: 2.6-47). Furthermore, individuals who slaughtered the cattle that had died suddenly were 7.6 times more likely to develop cutaneous anthrax compared to those who did not (aOR = 7.6, 95% CI: 2.1-28) (Table 1a).

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Table 1a: Risk factors associated with transmission during an anthrax outbreak: Amudat District, Uganda, December 2023–June, 2024

Compare to un exposed group (no contact with the dead cattle) individuals who engaged in the following activities had increased odds of becoming a case of anthrax: those who only slaughtered (OR=5.3, 95%CI:1.9-15), those who slaughtered and carried animal parts (OR=13, 95%CI:2.2-78), slaughtered and skinned (OR=8.1, 95%CI:2.1-31) and those who performed the 3 activities: slaughtered, carried animal parts and skinned (OR=19, 95%CI:2.6-136) (Table 2b).

Table 2b: Common group reference analysis of risk factors associated with cutaneous anthrax, Amudat District, Uganda, Dec 2023–Jun 2024

Cat: Category, S:Skinned. SC:Skinned and carried animal parts, SCS:Slaughtered, carried

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thrax in humans linked to direct contact or handling of deceased cattle and sleeping on their hides. The findings of this investigation are consistent with prior studies on anthrax outbreaks, indicating that patients contracted the disease through contact with infected livestock or contaminated materials (10,11).

In the Pokot community, young children, particularly those involved in cattle herding, predominantly use animal skins and hides as bedding. Our investigation identified sleeping on these materials as a risk factor for anthrax. Using skins or hides from infected animals increases the likelihood of direct contact with *Bacillus anthracis* spores, especially if the animals died from anthrax. This practice aligns with findings from other studies indicating that processing animal skins and hides for bedding can contribute to anthrax transmission among vulnerable populations(10,12).
We observed a significantly elevated risk of anthrax among individuals older than 20 years, consistent with findings from similar studies in Northern Tanzania and Uganda(10,13). This age group is more likely to engage in activities such as livestock handling, animal product processing, and agricultural work, which increase their exposure to anthrax spores.
Males were disproportionately affected by anthrax compared to females. This observation is likely due to the occupational roles primarily held by males in our study population, which involve direct contact with livestock. These roles include skinning, slaughtering, meat handling, and herding, activities that increase the risk of anthrax exposure through contact with contaminated animal products. The higher attack rate among males during anthrax outbreaks can be attributed to their predominance in these high-risk occupations. This underscores the importance of occupational exposure and traditional roles in influencing disease risk within specific demographic groups. Our findings are consistent with other studies conducted in Uganda in the previous years (14). We noted a number of children younger than 5 years among cases, owing to possible transmission from direct contact with infected parents such as touching them with unwashed hands or through shared bedding materials.

Study limitations
Some of the challenges of anthrax include its detection and surveillance. Detecting anthrax can be difficult due to the varying presentation of symptoms, especially in the case of gastrointestinal anthrax which can mimic other gastrointestinal infection, making health workers to overlook it. Additionally, the first outbreak in a region may further complicate detection and accurate reporting due to unfamiliarity with the disease and its non-specific symptoms

Conclusion
This study highlights the heightened risk of cutaneous anthrax among individuals who slaughtered or sleep on animal hides of animals that had died suddenly. To mitigate anthrax outbreaks, it is crucial to implement preventive measures such as routine vaccination of livestock, safe disposal of anthrax-infected carcasses, public awareness campaigns involving cultural and political leaders, immediate administration of antibiotics for all human anthrax cases, and enhanced surveillance systems across human, and animal sectors using the One Health approach.

Public health actions
During the investigation, we collaborated with the District Health team and local political leaders to organize community education sessions via radio talk shows, emphasizing the prevention and control of anthrax in both humans and animals. We ensured the safe burial of affected carcasses and educated the community on proper burial practices. Additionally, we provided targeted health education to healthcare staff, focusing on the effective management of anthrax cases

Conflict of Interest
The authors declared no conflict of Interest

Author contribution
PK, HK, EN, JM BK, RM, ARA conceived and designed the study. PK, HK contributed to data collection, cleaning and analysis. EN participated in coordination of laboratory work. PK, HK, EN, JM, BK, RM, ARA took lead in developing the bulletin. All authors contributed to the final draft of the bulletin. All the authors read and approved the final bulletin.
Acknowledgments
We extend our appreciation to the District leadership of Amudat District, Karita HC IV staff and village health teams (VHT's) for their cooperation and participation during the outbreak investigation.

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World Health Awareness Days, and International Health Days, October – December 2024

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Introduction

Global public health awareness days aim to increase visibility, awareness, and understanding of specific diseases or health conditions among the general public; they are key in highlighting the importance of healthy lifestyle and well-being among general population. Each year, various organizations and communities around the world actively participate in promoting and supporting World Health Days.

Breast Cancer Awareness Month- 01 to 31st October

This is a global healthcare event for the awareness of breast cancer, which we reflect on for the entire month of October every year for the past 37 years. This year, World Health Organization will reminisce the month under the theme “No-one should face breast cancer alone” with the objectives to drive advocacy, awareness, and behavior change communication, foster knowledge exchange, and strengthen multisectoral collaboration. Breast cancer is the most common cancer worldwide, with 2.3 million new cases annually accounting for one in eight cancer cases among both sexes and a quarter of all cancers in women, with 70% of deaths occurring in resource-constrained settings. Barriers within health systems, low awareness, and limited early detection contribute to late-stage diagnoses and poor outcomes, especially affecting younger populations in these regions and leading to high premature mortality and maternal orphans. Addressing breast cancer effectively has significant implications for gender equality, health equity, and achieving sustainable development goals (SDGs) 3.4 and 3.8, targeting reduced premature mortality from noncommunicable diseases and universal health coverage.

World Mental Health Day- 10th October

World Mental Health Day, observed annually on 10 October, raises awareness about mental health's critical role in individuals' and societies' well-being. This year’s theme, “Mental Health at Work,” highlights the importance of creating safe and supportive working environments. With 60% of the global population engaged in work; poor working conditions, stigma, and discrimination can significantly impact mental health, quality of life, and productivity. The COVID-19 pandemic and global conflicts have further exacerbated mental health challenges, underscoring the need for urgent action. Governments, employers, and organizations must collaborate with workers and those with lived experiences to implement evidence-based strategies that protect mental health in the workplace. Investments in mental health at work are important for fostering thriving individuals and communities.

International Infection Prevention Week 14th October- 20th October

International Infection Prevention Week, observed every 3rd week of October, highlights the critical role of infection prevention in safeguarding health. Hospital-acquired infections (HAIs) are a significant concern, affecting millions worldwide each year, with 23,000 deaths reported annually. Poor

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hygiene practices, inadequate cleaning, and overcrowding contribute to these infections, impacting both patients and healthcare workers. In high-income countries, 7 out of 100 patients develop HAIs during their hospital stay, while this rate increases to 15 out of 100 in low- and middle-income countries, with 10% of those affected dying as a result. The WHO emphasizes that 70% of infections can be prevented through proper hand hygiene and other simple, cost-effective measures. Strengthening hygiene practices in healthcare settings is essential to reducing the risk of HAIs and ensuring safer patient care.

Global Handwashing Day - 15th October

The global handwashing day, is celebrated on October 15th annually with the aim of increasing awareness on the importance of handwashing with soap as a simple, cost-effective way to prevent diseases like diarrhea and pneumonia. This day involves conducting cam-

Continues to page 62

larly with type 2 diabetes, which can often be prevented through lifestyle changes. World Diabetes Day serves as a global platform for education, advocacy, and promoting better access to treatment to combat this silent killer.

Figure 3: Joanita Nalwanga and Joyce Owens Kobusingye wearing rapid response jackets interviewing suspected cases during Mpox case investigation, Kasese District, August 2024

World Antimicrobial Awareness Week (WAAW)- 18th to 24th November

This is an event organized every year with a theme aiming to raise awareness and understanding of antimicrobial resistance and promote good practices among one health stakeholders with the purpose of reducing the emergency and spread of re-

Figure 4: Dr Emmanuel Mfitundinda, standing, conducting a continuous medical education during investigation of a strange disease in Bundibugyo District, September 2024

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Figure 5: Fellows, wearing rapid response jackets, interacting with a community member during Leprosy investigation in Nebbi and Koboko Districts, July-August 2024

Figure 6: Annet Mary Namusisi (extreme left) interacting with a breastfeeding mother during measles outbreak investigation in Moroto District, July 2024

sistant infections. This year's antimicrobial awareness week will be celebrated with the theme "Educate, Advocate, Act now".

World AIDS Day- 1st December

World AIDs day is commemorated annually on 1st December to raise awareness on HIV/AIDs, celebrate achievements made towards fighting the pandemic and the lives that have been lost to the disease while intensifying efforts towards its control.

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Figure 7: Dr Hannington Katumba interviewing an Mpox case-person at Bwera Hospital Isolation Unit, September 2024

ing countries. These individuals face significant barriers to

Figure 8: Dr Hannington interviewing a mother during the Uganda National Immunization mini-survey, near the Uganda - DRC border in Bundibugyo District, September 2024

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Figure 9: Emmanuel Okiror Okello during active case search for Acute Flaccid Paralysis in Mbale District, in July 2024

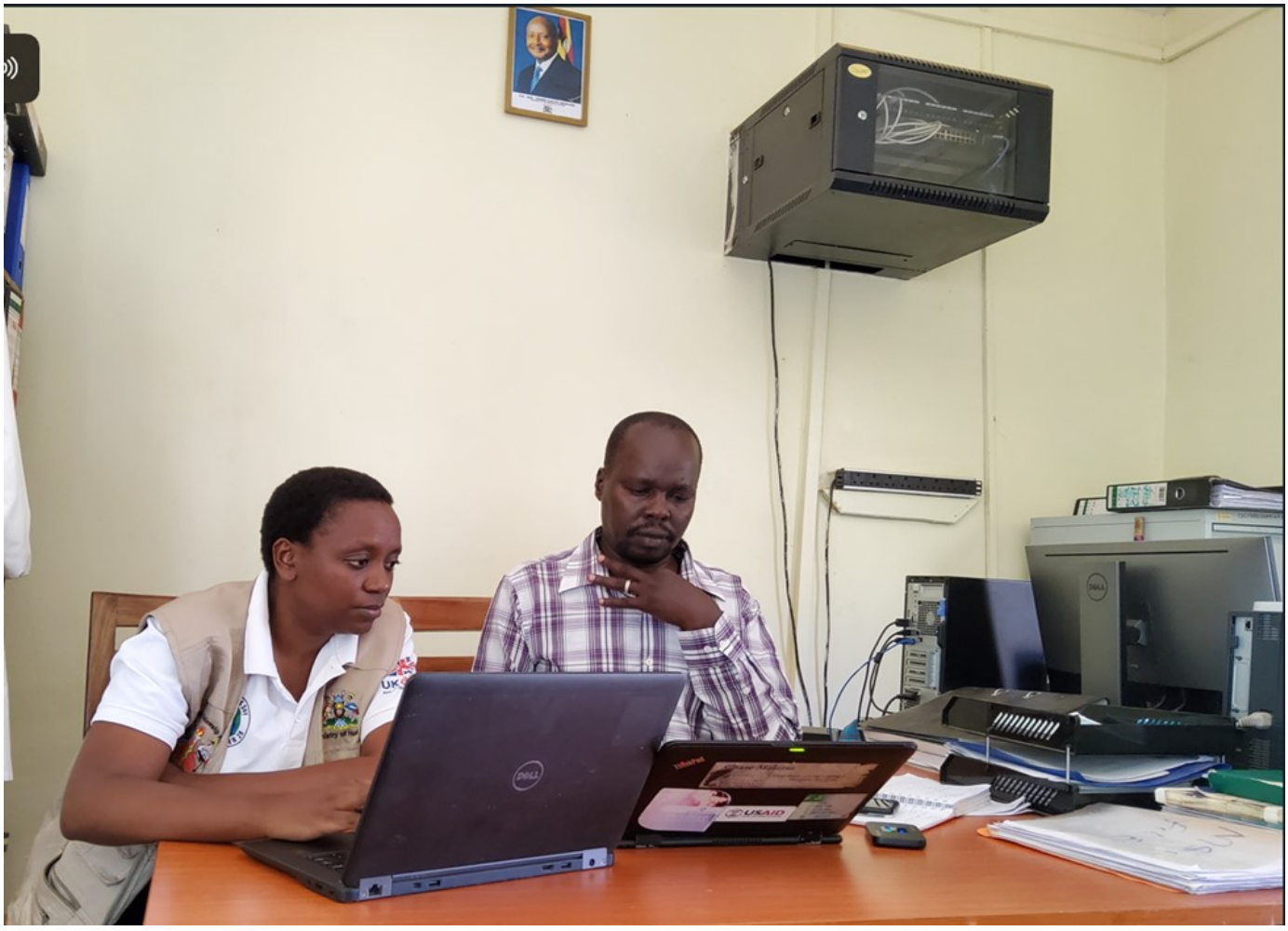

Figure 10: Left: Esther Nabatta (LLP fellow) supporting the District Laboratory Focal Person in tracking referred samples during Anthrax outbreak investigation in Amudat District, June-July 2024

healthcare, including attitudinal, physical,