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Readiness of health public facilities to diagnose, manage, and prevent the Ebola epidemic along border districts in Southwestern Uganda

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Abstract

Background Ebola Virus Disease (EVD) outbreaks typically start from a single case of a probable zoonotic transmission and evolve into an epidemic because of the local and international movement of people, causing a global health security threat. This study aimed to assess the readiness of health facilities in the border districts of Southwestern Uganda towards prevention, diagnosis and management of EVD.

Methods This was a cross-sectional study conducted between July and September 2024. The study was conducted in the districts that share a border with the Democratic Republic of Congo, which were Kasese, Kanungu, and Kisoro districts. Data was collected using the World Health Organization Consolidated Ebola virus disease preparedness checklist, which was modified to suit the study objectives.

Results A total of 214 health facilities were surveyed, including 118 (55.1%) Health centre IIs, 76 (35.5%) health centre IIIs, 9 (4.2%) Health centre IVs and 11 (5.1%) Hospitals. The overall prevention capacity was moderate with a mean score of 62.0 (±12.5), and only 88 (41.1%) had high prevention levels. Hospitals, 10/11 (90.9%) and Health centre IVs, 6/9 (65.2%) were more prepared to prevent EVD outbreaks as compared to lower-level facilities ($p=0.041$). The mean score for facility readiness to diagnose EBV outbreak was 61.0% (±13.2). Only half, 116 (54.2%), had trained laboratory personnel to handle an EVD outbreak. Management capacity was the weakest domain, with only one-third, 72/214 (33.6%) of all facilities rated high and a mean score of 55.0 (±14.0). Major gaps were noted in the availability of burial/decontamination teams, 85 (39.7%) and contingency funding, 74 (34.6%).

Conclusion The overall level of preparedness to manage EVD outbreak was moderate, with most facilities lacking essential preventive, diagnostic and treatment components, calling on the MoH and its partners to intensify cross-border surveillance, coordination, and capacity-building efforts at the health facility level.

Keywords Ebola Virus Disease, EVD preparedness, Health facility readiness, Border districts, Uganda

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Introduction

Infectious diseases are responsible for 25% of global annual deaths, with significant contributions from both epidemics and pandemics [1]. From 1976 to 2020, there have been 29 outbreaks, mainly in West and East Africa [2]. Isolated EVD outbreaks have been reported in South Africa, the USA, the UK, and Italy [2]. The most recent EVD outbreak in Uganda, confirmed on 30 January 2025, had 12 confirmed cases and four deaths. Over 534 people were identified as contacts to the confirmed cases, and the outbreak took a 42-day countdown to declare it over officially [3]. The average Ebola disease case fatality rate is around 50% [4]. Case fatality rates have varied from 25 to 90% in past outbreaks [4]. The most severe epidemic to date, the 2014–2016 West-African outbreak, resulted in over 11 000 deaths and imposed an economic burden exceeding US $53 billion [4, 5]. Ebola Virus Disease (EVD) outbreaks typically start from a single case of a probable zoonotic transmission and evolve into an epidemic because of the local and international movement of people, causing a global health security threat [6].

Most EVD outbreaks in Uganda have always been tracked to originate from the neighboring Democratic Republic of Congo (DRC). The zoonotic transmission nature of EVD, facilitated by extensive deforestation, migration at porous borders, and poor healthcare surveillance systems, has enabled the majority of its epidemics to occur in Uganda and other African countries [7, 8]. Cross-border movements and trade thus remain the major risk factor for multi-country transmission of EVD [9].

In response to the frequent EVD outbreaks, the Uganda's ministry of health supported by the WHO and other development partners have activated robust preparedness mechanisms, including the deployment of the Public Health Emergency Operations Centre (PHEOC), the National Task Force (NTF), district-level rapid response teams, and health facility infection prevention and control (IPC) measures across high-risk zones [10]. However, assessments conducted during the 2018–2019 preparedness phase revealed critical gaps: many high- and moderate-risk districts scoring below 50% in EVD readiness, with particular deficiencies in areas such as safe burial practices, budgets, and contact tracing [11].

Uganda and DRC have experienced multiple Ebola outbreaks in recent years, highlighting the ongoing risk of EVD cross-boarder transmission. It is therefore imperative to assess the readiness of border districts in Southwestern Uganda for the prevention, diagnosis, and management of EVD. This evaluation will identify critical strengths and gaps, providing evidence to inform future policy, resource allocation, and outbreak preparedness in high-risk areas.

Materials and methods

Study design and duration

This was a cross-sectional study employing quantitative techniques and was conducted between July and September 2024.

Study setting

The study was conducted in the Southwestern part of Uganda in the districts that share a border with the Democratic Republic of Congo, which were Kasese, Kanungu, and Kisoro districts as shown in Fig. 1 below. These districts were purposively selected due to the presence of an international border with DRC, a country that has experienced multiple EVD outbreaks in recent years, posing a high risk of cross-border transmission.

In Uganda, the health system is organized in a hierarchical referral structure, ranging from Health Centre II at parish level, Health Centre III at sub-county level, Health Centre IV at county level, to general hospitals and referral hospitals. Lower-level facilities (HCII and HCIII) primarily provide basic preventive and curative services, while more complicated cases are referred to higher-level facilities (HCIVs and hospitals), which are expected to offer inpatient, emergency, and specialized care. Government health facilities form the backbone of service delivery in rural and border areas and are mandated by the Ministry of Health to implement national epidemic preparedness and response strategies, including Ebola Virus Disease (EVD) surveillance, reporting, and case management. They also serve as the first point of contact for most patients and play a central role in the public health referral and notification system. Although non-public facilities, including private-for-profit and private-not-for-profit (PNFP) providers such as mission hospitals and clinics, contribute to healthcare delivery in the study districts, they vary widely in capacity, reporting structures, and integration into the national surveillance system.

Study population

The study population comprised government (public) health facilities in the border districts of Kasese, Kanungu, and Kisoro. We focused on public health facilities because they are directly supported and supervised by government, uniformly expected to implement the WHO and Ministry of Health EVD preparedness guidelines, and constitute the primary facilities designated for outbreak detection, referral, and initial response in border communities. We excluded specialized or single-service facilities such as dental clinics and maternity-only centres that are outside the scope of the EVD preparedness assessment.

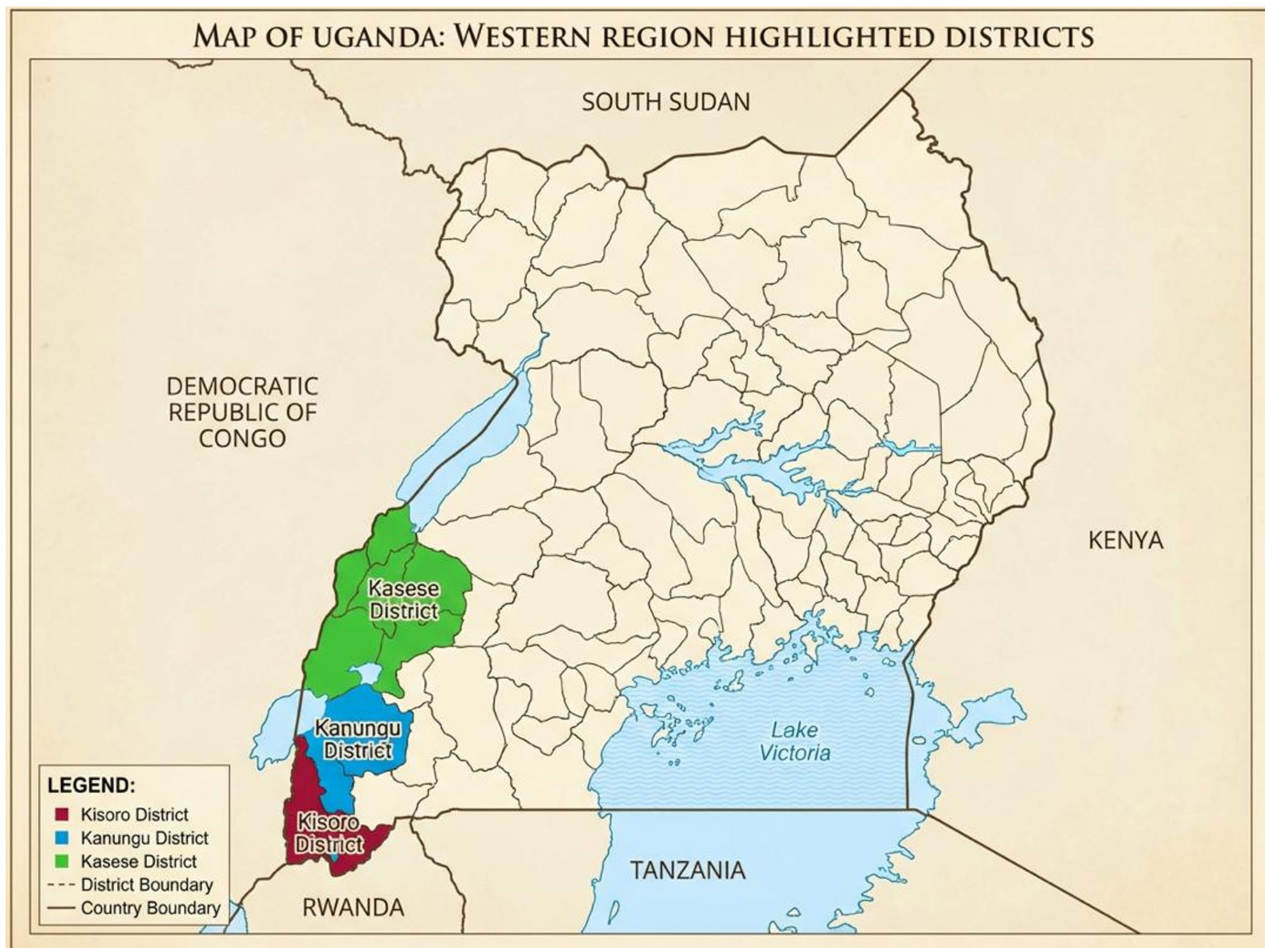

Fig. 1 A map of Uganda showing border districts with the Democratic Republic of Congo

Sample size determination

Due to the small number of public health facilities in the selected districts ($n = 214$), a census approach where all eligible facilities were included was used to maximise statistical power and data reliability.

Data collection methods, tools and procedures

Data was collected using the WHO Consolidated Ebola virus disease preparedness checklist, which identifies 11 key preparedness components for both countries and the international community [12]. Since the tool was designed for the whole healthcare system, it was modified to assess only components applicable to health facilities. These were further reorganised into prevention, diagnosis and management components. The data was collected through interviews with health facility administrators/in-charges after confirmation of the physical presence and functional status of key elements.

Measurement of key variables

The outcome variable was health facility readiness to diagnose, manage, and prevent Ebola Virus Disease (EVD), measured using a composite readiness score based on predefined indicators adapted from the 2015 WHO Consolidated Ebola virus disease preparedness checklist [12].

Readiness to prevent EVD was measured using 12 parameters assessing preparedness structures, IPC systems, and surveillance capacity. These included: availability of a facility Ebola task force or committee; identification and training of an incident manager; training of rapid response teams; conduct of simulation exercises or drills; availability of IPC guidelines and SOPs; availability of basic hygiene and sanitation infrastructure, disinfection materials, PPE and IPC services; training of healthcare workers in IPC and waste management; presence of a basic isolation unit (at least two beds); dissemination of simplified EVD case definitions to staff and community; training of HCWs on case definitions and use of investigation forms; availability and dissemination of contact tracing guidelines and SOPs; and presence of at least one trained contact tracing team. Each parameter was scored as **1** if available and **0** if not available, giving a maximum prevention score of 12.

Readiness to diagnose EVD was assessed using four parameters evaluating the facility's ability to identify suspected cases and safely handle specimens. These included: availability of protocols for specimen collection and shipment; training of laboratory personnel on safe specimen collection, packaging, labelling, and referral; access to immediate reporting mechanisms for suspected EVD cases (alive or dead); and availability of a 24-hour hotline or emergency contact to manage alerts. Each parameter was scored as **1** if present and **0** if absent, yielding a maximum diagnostic score of 4.

Readiness to manage EVD cases was measured using nine parameters assessing clinical care, IPC, logistics, and resource mobilization capacity. These included: availability of adequate supplies and isolation rooms for suspected cases; identification and training of clinical staff in EVD case management and IPC; availability of SOPs for safe and dignified burials; training of ambulance teams where facility-managed ambulances existed; availability of at least one equipped burial or decontamination team; ensuring isolation structures had IPC facilities, waste management systems, water, and power supply; identification of suppliers of essential items such as PPE, disinfectants, and medical supplies; availability of an accessible contingency fund for immediate response; and identification of funding sources and mechanisms to mobilize additional resources if required. Each parameter was scored as **1** if present and **0** if absent, giving a maximum management score of 9.

For different domains, facilities scoring ≥ 70% in a domain were classified as having *high readiness*, 50–69% as *moderate readiness*, and < 50% as *low readiness* for that domain. Overall facility readiness was computed as the average score across the three domains.

Data analysis

Data were analysed using STATA 17.0 (Stata Corp, College Station, Texas, USA). Descriptive statistics, including frequencies, percentages, means, and standard deviations, were used to summarise the facility characteristics and the availability of resources, infrastructure or protocols for Ebola preparedness. Readiness scores were computed based on predefined indicators, and categorical variables were compared using Chi-square tests. Statistical significance was set at $p < 0.05$.

Ethical consideration

The protocol was reviewed and approved by the Mbarara University of Science and Technology research ethics committee (MUST-2024-1374) and the Uganda National Council of Science and Technology (registration number HS4575ES). The study was done in accordance with the Declaration of Helsinki. Privacy was ensured by anonymizing facility names and using unique numbers instead, while confidentiality was maintained by securely storing all electronic data in password-protected files. No identifying information about individual facilities or respondents was included in reports or publications.

Results

Facility characteristics

A total of 214 health facilities were included in the study. The majority were from Kasese District 146 (68.2%), followed by Kisoro 41 (19.2%), and then Kanungu 27 (12.6%). More than half were Health Centre IIs, 118 (55.1%), while 76 (35.5%) were Health Centre IIIs. A smaller proportion were higher-level facilities, including HCIVs, 9 (4.2%) and hospitals, 11 (5.1%) as shown in Table 1 below.

Table 1 Characteristics of health facilities assessed for readiness to diagnose, manage, and prevent the Ebola epidemic along border districts in Southwestern Uganda

Variable	Frequency ($n = 214$)	Percentages
District		
Kasese	146	68.2
Kanungu	27	12.6
Kisoro	41	19.2
Level of facility		
HCII	118	55.1
HCIII	76	35.5
HCIV	9	4.2
Hospitals	11	5.1

Availability of essential elements for EVD preparedness

In terms of prevention, 170 (79.4%) of health facilities had infection prevention and control (IPC) guidelines and SOPs, and 156 (72.9%) had basic hygiene, sanitation, and PPE services, while 137 (64.0%) had established Ebola task forces. However, only 86 (40.2%) health facilities had conducted simulation exercises, and less than half, 101 (47.2%), had basic isolation units. For diagnosis, 140 (65.4%) had access to immediate reporting lines, 137 (64.0%) had protocols for specimen collection, and just over half, 116 (54.2%), had trained laboratory personnel to handle an EVD outbreak. Regarding management, 91.2% ($n = 11/12$) of facilities with ambulances had trained ambulance teams, and more than half had adequate isolation rooms, 128 (57.5%) and essential supplies, 112 (57.0%). Major gaps were noted in the availability of burial/decontamination teams, 85 (39.7%) and contingency funding, 74 (34.6%) (Table 2).

Health facility readiness to diagnose, manage, and prevent the Ebola epidemic

The overall prevention capacity was generally moderate, with only 88 (41.1%) of health facilities classified as high and a mean score of 62.0 (± 12.5). Higher prevention

Table 2 Availability of key elements for prevention, diagnosis and management of Ebola epidemic in health facilities along border districts in Southwestern Uganda

Elements available	Frequency	Percentage
Elements for prevention		
Have a facility-level committee/Ebola Task Force	137	64.0
Have identified, trained and designated an incident manager	129	60.3
Provide training for the rapid response teams	128	59.8
Tested coordination and operations through simulation exercises and drills.	86	40.2
Have infection prevention and control guidelines and SOPs.	170	79.4
Have basic hygiene, sanitation, disinfection, PPE, and other IPC services	156	72.9
Train HCWs on IPC measures and waste management.	135	63.1
Have a basic isolation unit (e.g., two beds).	101	47.2
Disseminate simplified case definitions to staff and community.	129	60.3
Train HCWs on case definitions and use of investigation forms.	115	53.7
Contact tracing guidelines and SOPs available and disseminated to HCWs	126	58.9
At least one trained team for contact tracing	110	51.4
Elements for diagnosis		
Protocols for specimen collection and shipment.	137	64.0
Train laboratory personnel on safe collection, packaging, labelling, and referral.	116	54.2
Access to immediate lines of reporting for potential EVD cases (dead or alive).	140	65.4
Have a 24/7 hotline or existing emergency numbers to manage/receive alerts	125	58.4
Elements for management		
Adequate supplies and isolation room(s) for suspected cases.	123	57.5
Identify and train clinical staff on EVD case management and IPC.	114	53.3
SOPs for safe and dignified burials	109	50.9
Train ambulance teams (if facility-managed ambulances) ($n = 12$)	11	91.2
Equip at least one burial/decontamination team	85	39.7
Ensure isolation structures have IPC facilities, waste management, water, and power.	117	54.7
Identify suppliers of essential items (PPE, disinfectants, medical supplies).	122	57.0
Have accessible contingency fund for immediate response to an EVD outbreak	74	34.6
Identified funding sources and mechanisms to raise additional resources if necessary.	85	39.7

levels were observed among hospitals, 10/11 (90.9%) and HCIVs, 6/9 (65.2%), compared to lower-level facilities ($p = 0.041$). The mean score for facility readiness to diagnose EBV outbreak was 61.0 (± 13.2), although differences across districts and facility levels were not statistically significant ($p = 0.067$). Management capacity was the weakest domain, with only one-third, 72/214 (33.6%) of all facilities rated high and a mean score of 55.0 (± 14.0). Facilities at the hospital level had a high level of preparedness, 9 (81.8%), as compared to lower-level facilities (Table 3).

Discussion

This research was set to assess the health facility readiness to diagnose, manage, and prevent the Ebola epidemic along the border districts of western Uganda. The study revealed a moderate level of health facility preparedness to prevent, diagnose and manage EVD outbreak. These gaps are concerning given the high-risk status of these districts, which share porous borders with the Democratic Republic of Congo, a recurrent epicenter for EVD. The findings of this study are consistent with the findings of previous studies done in western Uganda, which also showed moderate levels of facility preparedness to handle EVD outbreaks. A previous study done in Kasese and Rubirizi districts showed that only half of the health facilities had at least 50% of infrastructural and logistical capabilities, nearly half of the health facilities did have a spacious triage area as well as spaces that could allow a one-meter distance between the HCW and the patient and infection prevention control guidelines were only observed in only 17 health facilities [11]. EVD management protocols, safe burial and disposal of corpse's guidelines and personal Protective Equipment are generally lacking in most Ugandan health facilities [11]. The observed disparity in readiness levels between higher-level facilities (Hospitals and HC IVs) and lower-level facilities (HC IIs and IIIs) underscores the structural challenges within the Ugandan health system. The low level of facility preparedness observed in this study may be attributed to the fact that this study assessed all levels of health facilities (HCII to hospitals), while in Uganda, the health system operates in a hierarchical manner where lower-level facilities, such as HCIIs and HCIIIs, are primarily designed to provide basic health services and are expected to refer more complicated cases to

Table 3 Health facility readiness to diagnose, manage, and prevent the Ebola epidemic

Parameter	Frequency (percentage)							
	Overall	**Kasese**	**Kanungu**	**Kisoro**	**HCII**	**HCIII**	**HCIV**	**Hospital**
Prevention								
Mean % (SD)	62.0 (± 12.5)	63.5 (± 11.8)	58.2 (± 13.1)	60.1 (± 12.9)	59.0 (± 12.4)	64.8 (± 11.5)	65.2 (± 13.0)	67.0 (± 10.9)
High	88 (41.1)	62 (42.5)	9 (33.3)	17 (41.5)	39 (33.1)	33 (43.4)	6 (66.7)	10 (90.9)
Moderate	93 (43.5)	61 (41.8)	12 (44.4)	20 (48.8)	57 (48.3)	33 (43.4)	2 (22.2)	1 (9.1)
Low	33 (15.4)	23 (15.8)	6 (22.2)	4 (9.8)	22 (18.6)	10 (13.2)	1 (11.1)	0 (0)
Diagnosis								
Mean (SD)	61.0 (± 13.2)	61.5 (± 12.5)	59.8 (± 13.9)	60.2 (± 14.1)	58.0 (± 12.6)	63.2 (± 13.0)	64.5 (± 14.3)	66.0 (± 12.7)
High	80 (37.4)	56 (38.4)	10 (37)	14 (34.1)	35 (29.7)	30 (39.5)	4 (44.4)	11 (100)
Moderate	102 (47.7)	70 (47.9)	12 (44.4)	20 (48.8)	62 (52.5)	36 (47.4)	4 (44.4)	0 (0)
Low	32 (15)	20 (13.7)	5 (18.5)	7 (17.1)	21 (17.8)	10 (13.2)	1 (11.1)	0 (0)
Management								
Mean (SD)	55.0 (± 14.0)	55.8 (± 13.5)	53.0 (± 14.2)	54.5 (± 14.5)	52.0 (± 13.9)	57.0 (± 13.6)	58.0 (± 14.1)	61.5 (± 13.0)
High	72 (33.6)	51 (34.9)	9 (33.3)	12 (29.3)	28 (23.7)	30 (39.5)	5 (55.6)	9 (81.8)
Moderate	94 (43.9)	65 (44.5)	11 (40.7)	18 (43.9)	65 (55.1)	24 (31.6)	3 (33.3)	2 (18.2)
Low	48 (22.4)	30 (20.5)	7 (25.9)	11 (26.8)	25 (21.2)	22 (28.9)	1 (11.1)	0 (0)

higher-level facilities, such as HCIVs and hospitals [13]. While the referral model correctly designates higher-level facilities for complex case management, the reality of EVD transmission necessitates robust preparedness at the lowest level of care. As a result, these lower-level facilities may not be fully equipped or staffed to handle all emergencies, which contributes to the overall lower preparedness observed in the study. However, being in hotspot areas for EVD spread from the neighboring Democratic Republic of Congo, the absence of essential elements undermines the overall preparedness to manage the EVD outbreak by Uganda's health care system. The moderate prevention scores in lower-level facilities suggest that while guidelines may exist, the practical application remains inconsistent. This indicates a need to re-evaluate how national preparedness guidelines are operationalized and resourced at the peripheral level. The scarcity of contingency funding (34.6%) represents a critical operational bottleneck. The absence of accessible contingency funds reveals a reliance on donor funding. In the rapid onset of an epidemic, the ability to immediately mobilize resources for PPE, and staff allowances is crucial for containment of an outbreak. This current gap suggests that national frameworks should include financial resources in form of a contingency fund for all border districts necessary for an immediate ground response in the event of an epidemic.

Study limitations

Being a cross-sectional study, we captured preparedness at a single point in time, which may not reflect changes over time, especially during outbreaks or after interventions. Follow-up studies during times of the outbreak may be warranted to paint a clear picture of facility preparedness. Also, the assessment was restricted to public health facilities, which may limit the generalizability of the findings to private-for-profit and private-not-for-profit facilities that also contribute to healthcare delivery in the study districts. The use of purposive sampling for selecting public health facilities might have introduced selection bias.

Conclusion

The overall level of preparedness to manage EVD outbreak was moderate, with most facilities lacking essential preventive, diagnostic and treatment components, calling on the MoH and its partners to intensify cross-border surveillance, coordination, and capacity-building efforts at the health facility level. Strengthening the low-level health facilities will ensure timely detection, prompt referral, and effective management of suspected EVD cases, thereby reducing the risk of widespread transmission.

Although this study provides important insights into EVD preparedness among public health facilities in border districts of Southwestern Uganda, the findings should be interpreted in light of the study's limitations, particularly the focus on public facilities, which may limit generalizability to non-public providers.

Abbreviations

DRC	Democratic Republic of Congo
EVD	Ebola Virus Disease
HCII	Health Centre II
HCIII	Health Centre III
HCIV	Health Centre IV
IPC	Infection Prevention and Control
MUST REC	Mbarara University of Science and Technology Research Ethics Committee
NTF	National Task Force
UK	United Kingdom
UNCST	Uganda National Council of Science and Technology
USA	United States of America

WHO World Health Organization

Supplementary Information

The online version contains supplementary material available at https://doi.org/10.1186/s12913-026-14119-8.

Supplementary Material 1

Supplementary Material 2

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Author contributions
J.S. conceived the study, wrote the main manuscript text, and was responsible for the overall coordination of the study. E.K . edited the main manuscript. B.D. and C.N. participated in field work, data collection, and cleaning. M.R. was responsible for data analysis and writing of the main manuscript, D.B and A.K participated in the study and fieldwork coordination and contributed to editing the manuscript. All authors have read, edited, and approved the manuscript.

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Data availability
The data used for analysis is all presented here.

Declarations

Ethics approval and consent to participate
Before undertaking the study, the proposal was submitted for ethical clearance at Mbarara University of Science and Technology research ethics committee (MUST-2024-1374) and the Uganda National Council of Science and Technology (registration number HS4575ES). Written informed consent was obtained from each participant. Permission to go to the health facilities was sought from the District health offices and respective in-charges of hospitals and the health facilities. Privacy was ensured by hiding facility names and using unique numbers instead, while confidentiality was maintained by securely storing all electronic data in password-protected files.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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