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ORIGINAL ARTICLE

Implementation of a cascade training model to enhance emergency care capacity of healthcare workers during the COVID-19 outbreak in Uganda

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ABSTRACT

Introduction: The COVID-19 pandemic highlighted the gaps and the need to strengthen the emergency care system in Uganda. The Ugandan Ministry of Health implemented an emergency care capacity-building program during the COVID-19 pandemic response to improve COVID-19 case management in Uganda. We describe the curriculum development and rollout using a cascade model.

Methods: In June 2021, the World Health Organisation (WHO) Hospital Emergency Unit Assessment Tool (HEAT) was used to assess emergency units and document existing capacity gaps in regional referral hospitals and general hospitals. The WHO Basic Emergency Care curriculum was modified to a training curriculum for emergency care principles for COVID-19 management. Training of trainers was conducted across 14 health regions in July and August 2021. The trainers trained cascaded the training through facility-based training during continuous professional development sessions.

Results: Using the HEAT, 115 health facilities (14 regional and 101 general hospitals) were assessed. Only 31.3% (36/115) of the health facilities had a formal triage system. 53.5% (54/101) of general hospitals lacked non-rotating staff in the emergency unit. Some 511 healthcare workers from 205 facilities were trained as trainers, of whom 51.8% were nurses. The trainers trained cascaded the training to 3,550 healthcare workers. There was a significant difference between the overall median pre-test (71%) and median post-test (86.8%) scores of trainers trained ($p<0.001$).

Conclusion: There was a general lack of emergency unit protocols and a shortage of fixed staff at the emergency units. The cascade model facilitated the dissemination of emergency care knowledge to seven times more healthcare workers than the trainers trained. This demonstrates the efficiency of this approach in knowledge dissemination and its ability to be replicated in other low resource settings.

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Introduction

Emergency care involves rapid identification of acutely ill or injured patients and initiation of an intervention to avert death and disability for which delays can worsen prognosis or render care less effective [1]. Emergency care systems address a wide range of conditions, including injuries, communicable and non-communicable diseases, and pregnancy complications [1,2]. Like other low and middle income countries (LMICs), the emergency care system in Uganda is still underdeveloped [3]. The COVID-19 pandemic placed an additional strain on the entire health system, including the emergency care services [4,5].

As part of national efforts to strengthen the emergency care system, the Ministry of Health (MoH) launched the National Emergency Medical Services (EMS) policy in November 2021 [6]. This policy guides the development of a dedicated human resource for emergency care through training and capacity building [7]. Capacity building through short courses and skills training has been shown to increase healthcare workers' knowledge and performance in multiple aspects of emergency care [8–11].

A complementary strategy to improve emergency services is equipping emergency units (EU) with protocols for managing emergency cases [12–14]. The Uganda Emergency Care System Assessment (ECSA) conducted in 2016 identified several action priorities, including the improvement of emergency unit processes with standard protocols, and dedicated emergency care training for frontline providers [3].

The cascade model of training is a structured approach in which a small group of highly skilled trainers initially receives in-depth training. These trained individuals then pass on their knowledge by training the next level of participants, who, in turn, train others, creating a 'cascade' effect [15]. This process continues until the final target group, often frontline healthcare workers, is reached [16]. Cascade models of training have been used widely in knowledge dissemination in healthcare. These have been used in areas of immunization, emergency care, and maternal and child health and have been reported to have positive results on the knowledge of healthcare workers [17–19].

We describe the assessment of the capacities of EUs, the development of a curriculum, and its scale using a cascade model to enhance the emergency care capacity of healthcare workers during the COVID-19 outbreak in Uganda.

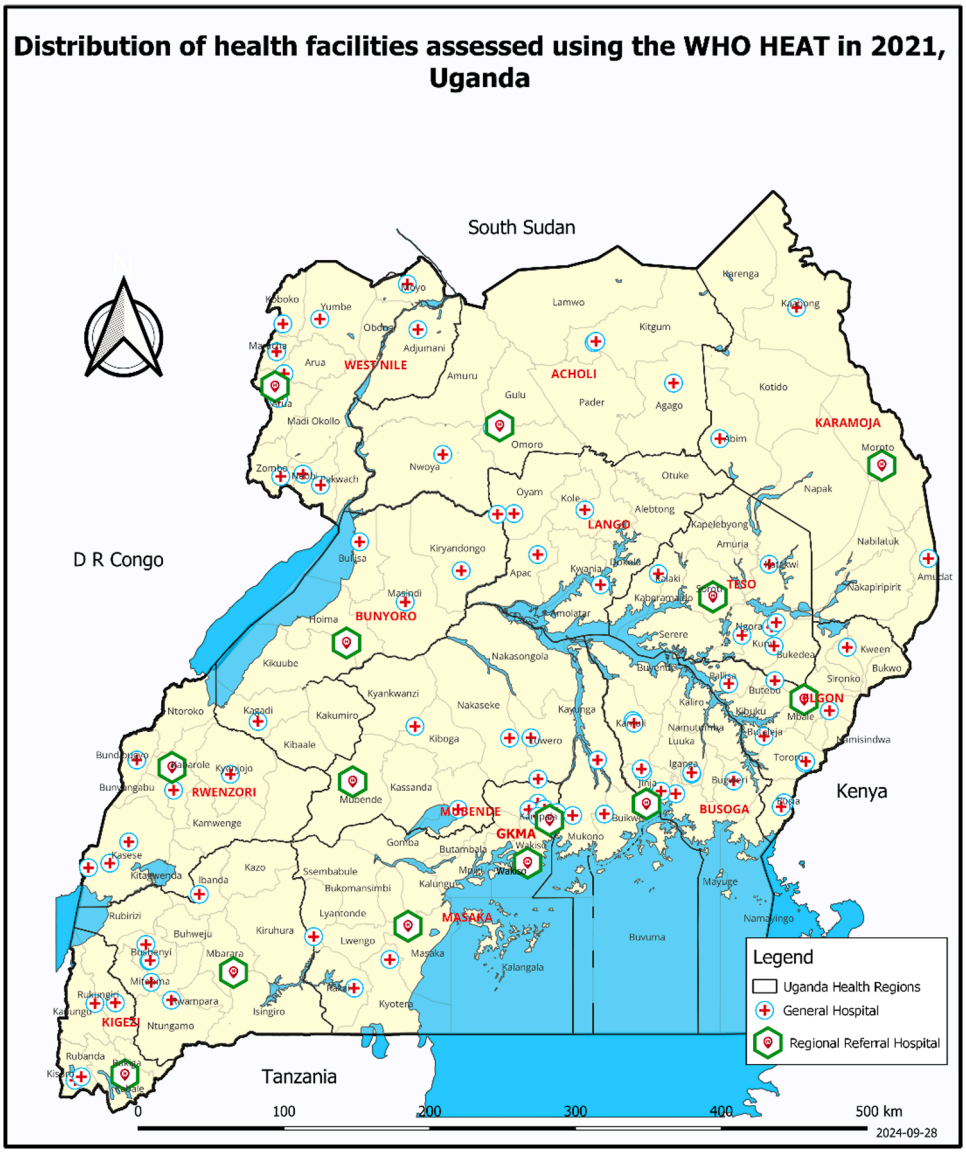

Fig. 1. Distribution of health facilities assessed using the WHO HEAT in 2021, Uganda.

Methods

Context

The capacity-building program was conducted as part of the Strengthening Partnerships for Preparedness and Response in Uganda project, a collaboration between the Ministry of Health (MoH) and the Infectious Diseases Institute (IDI) with support from the US Centres for Disease Prevention and Control (CDC). At the time of implementation, the country was divided into 14 health regions; Acholi, Lango, West Nile, Karamoja, Teso, Elgon, Busoga, Greater Kampala Metropolitan Area, Mubende, Bunyoro, Rwenzori, Masaka, Ankole, and Kigezi (Fig. 1).

Emergency health services in Uganda

Emergency health services in Uganda are coordinated by the Ministry of Health and delivered through a network of health facilities and providers nationwide. Ambulance services are available in Uganda to transport patients from the scene of an emergency to health facilities or between health facilities. Uganda's healthcare system is organized in a tiered structure. At the primary level, Health Centre I (village health teams) offers basic services through community health workers. Health Centre II provides outpatient care and is staffed by nurses and midwives. Health Centre III offers outpatient, maternity, and laboratory services, with clinical officers and nurses. Health Centre IV functions as a mini-hospital with inpatient services and an operating theater, staffed by doctors and clinical officers. General Hospitals (GH) offer more specialized care, and Regional Referral Hospitals (RRH) and National Referral Hospitals (NRHs), provide advanced specialized services, staffed by specialists and consultants. Emergency care is provided at these facilities, with higher-level facilities equipped to handle more complex cases. Basic emergency medical care is provided at health centres and hospitals nationwide. At all health facilities, patients should be triaged and offered emergency management before admission, discharge or referral.

Learning/capacity needs assessment

In June 2021, an assessment of EUs was conducted using an adopted World Health Organization (WHO) Hospital Emergency Unit Assessment Tool (HEAT) at 115 health facilities (14 RRHs and 101 GHs) by a multidisciplinary clinical team. Only RRHs and GHs were assessed due to funding limitations. The HEAT is a questionnaire and observation checklist that assesses facility characteristics, human resources, and clinical services. The assessor administered the HEAT to EU staff and made observations.

Curriculum development

The gaps and challenges identified in the HEAT assessment informed the development of a curriculum. From May to June 2021, MoH convened a multi-stakeholder consultative meeting for 4 days and multiple online correspondences to develop a training curriculum for basic emergency care principles applicable to COVID-19 care (Appendix 2). The stakeholders included MoH technical staff, specialists from RRHs, professional associations, academia, and implementing partners (Appendix 3).

The team reviewed existing emergency care curricula, including the WHO Emergency Triage Assessment and Treatment (ETAT) [20], Basic Emergency Care Course (BEC) [21] and a locally developed curriculum (WALIMU curriculum). The BEC was used as the basis for the curriculum since it is an approved WHO training and it had been used in many parts of the world to build emergency care capacity before COVID-19. The new curriculum developed was based on two BEC modules; standard ABCDE approach and difficulty in breathing since this was the main presentation of patients with COVID-19. The full BEC curriculum includes modules on ABCDE and SAMPLE history approach, trauma, difficulty in breathing, altered mental status plus transfer and handover. The Uganda triage and treatment algorithm (UTAT) was as developed as part of the curriculum development process using the BEC, ETAT, and interagency integrated triage tool (IITT) [22].

However, given the challenges of managing the pandemic such as staff shortage and competing funding priorities, it was not feasible to pull health workers for five days from their clinical duties. Therefore, the Ministry gathered a technical team consisting of individuals and partners who are involved in capacity building for emergency care in the country to recommend a training curriculum that mitigated the time and financial constraints but would be impactful across the country.

The cascade training

The main aspects of the cascade training process are summarised below.

Training of trainers (ToT)

Doctors, clinical officers, nurses, and midwives were invited from NRHs, RRHs and GHs, and selected high-volume Health Centre IVs (HC IVs) for training. Specifically, staff working at the EU or outpatient department were targeted. The number of trainees invited was proportionate to the population served by the health facility (Appendix 1). A total of 561 participants were selected for training; four participants were selected from each of 23 RRHs, three from each of 105 GHs, and two from each of 77 health centre IVs.

Two-day intensive training sessions for the ToT were held across the 14 health regions in Uganda from July to August 2021. The training teams included MoH technical staff, specialists from RRHs, professional associations, academia, and implementing partners (Appendix 3). The sessions were delivered as didactics, case studies, group discussions, demonstrations and simulations. Participants were required to perform key skills at different stations during the training sessions that involved drills and case simulations. A pre-test and post-test were done to assess knowledge acquisition according to the thematic areas of the developed curriculum. Wilcoxon signed-rank test was conducted to determine whether median pre-test and post-test scores were significantly different in each of the regions.

All facilities received paediatric and adult UTAT charts, trauma, medical and transfer checklists, and national health management information system tools. In addition, public facilities received a triage kit containing a manual blood pressure machine, stethoscope, thermometer and pulse oximeter.

Training of health workers by trainers

The trainers were tasked to fit the curriculum modules into the continuing profesional development calendar of their health facilities and deliver the training to their colleagues in their health facility meeting room or area.

Mentorship and Support

The regional EMS coordinators created WhatsApp groups with trainers, and one Google-sheet to track the progress of the cascade implementation weekly. The coordinators would then follow up and support facilities lagging in the cascade (Fig. 2).

Results

Learning/capacity needs assessment

Some 53.5% (54/101) of the assessed general hospitals lacked fixed

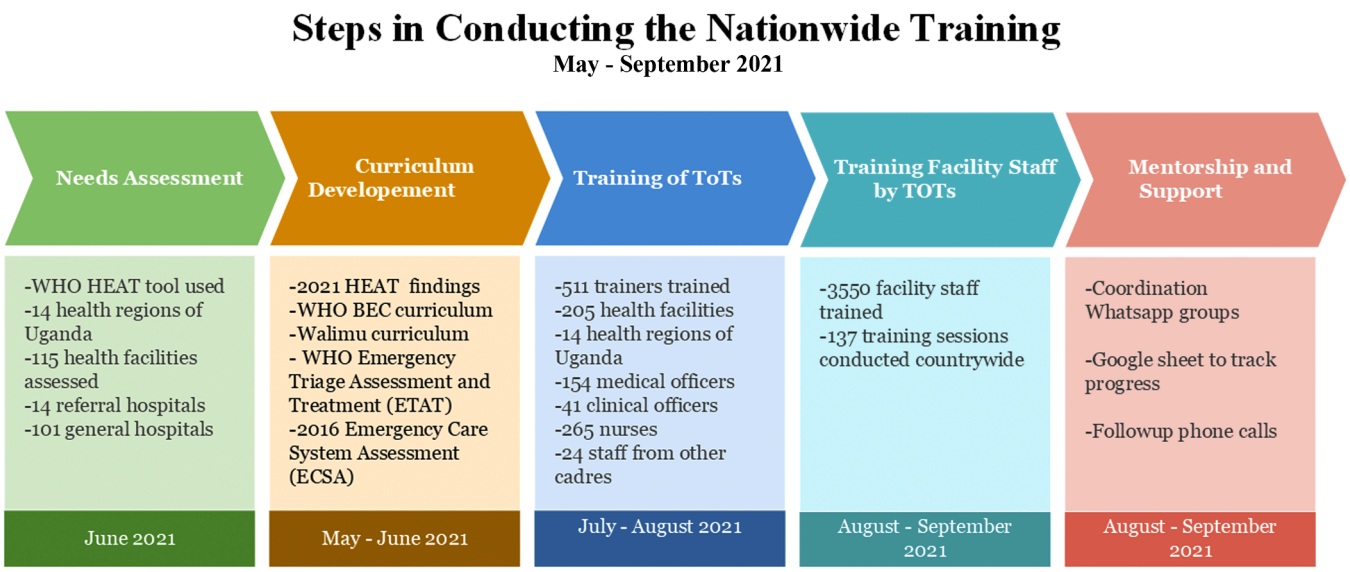

Fig. 2. A summary of the steps undertaken to conduct the countrywide cascade training in emergency care.

(non-rotating) staff at the EU whereas only 14.2% (2/14) RRHs lacked fixed staff at the EU. There was a general lack of specialist doctors at the EDs of both general and referral hospitals.

The needs assessment revealed that only 31.3% (36/115) of the facilities had a formal triage system. More RRHs 64.3% (9/14) had a formal triage compared to GHs 26.7% (27/101). Only 7.8% (9/115) had referral protocols (Table 1).

Curriculum developed

A two-day training curriculum for basic emergency care principles for COVID-19 management was developed (Appendix 2).

Number of trainers and health workers trained

A total of 511 trainers from 205 health facilities in the 14 regions were trained. Out of the 511 healthcare workers trained, nurses comprised the largest number 51.9% (265/511), followed by medical officers 30.1% (154/511), clinical officers 8.0% (41/511), midwives 5.2% (27/511), and 4.7% (24/511) were other cadres; laboratory technologists, orthopaedic officers, emergency medical technicians (EMTs) and anaesthetists. There was significant knowledge change among the trained trainers, from 71.0 (median pre-test) to 86.8 (median post-test) ($p<0.001$) (Table 2). On average, each trained health worker trained 7 health workers at their respective health facilities, reaching 3550 trainees.

Topics covered during cascade training

A total of 137 training sessions were conducted in three months (August -October 2021). The total attendance of the cascade training sessions was 3550 (Table 3). The topic that was covered most was "Triage and Introduction to the Uganda Triage and Treatment Algorithm". This was presented in 42 sessions (31.4%). This was followed by the "ABCDE Approach to a patient", covered in 29 sessions (21.2%). The least covered of those presented during cascade training was "Patient flow and setting up an Emergency Unit", which was covered in 2 sessions (1.5%) (Table 3). All facilities did not cascade the full curriculum. some of the reasons reported by trainers concerning lag in cascade delivery included the lack of time and skeleton staffing during the outbreak response, as well as the lack of training equipment.

Table 1
Results of the national needs assessment by thematic areas.

Area of assessment (n=115)	RRH n (%)	GH n (%)	Total n (%)
Triage			
The facility uses a formal triage system	9 (64.3)	27 (26.7)	36 (31.3)
Vital signs are measured in the triage area	10 (71.4)	25 (24.8)	35 (30.4)
Time targets for each triage category	8(57.1)	14 (13.9)	22 (19.1)
Availability of clinical management protocols			
The initial approach using ABCDEs	7 (50.0)	23 (22.8)	30 (26.1)
Trauma care checklist	7 (50.0)	6 (5.9)	13 (11.3)
Medical resuscitation checklist	6 (42.9)	5 (5.0)	11 (9.5)
Availability of patient referral protocols			
Presence of transfer or referral protocols	2 (14.3)	7 (6.9)	9 (7.8)
Communication with the receiving facility	11 (9.6)	1(7.1)	12(10.4)

Discussion

An assessment of the capacities of EUs showed a lack of EU process protocols and a lack of emergency physicians or other specialist doctors leaving a significant gap in emergency care mentorship of EU staff. We developed and rolled out the curriculum at sub-national levels using a cascade training model leading to a significant knowledge improvement across all regions.

Most health facilities in Uganda had limited availability of EU process protocols. This is consistent with previous assessments [3,23]. Some of the possible reasons for this consistent unavailability include the lack of a national framework to standardise protocols and a training curriculum. In Uganda, the national EMS policy was launched in November 2021. The draft EMS policy guided the development of protocols for this intervention before it was launched. This policy was finalized and

Table 2
Number of health facilities, training of trainers, median pretest and posttest scores.

	Health Facilities(n)	Training of Trainers(n)	Pretest Median Score	Posttest Median Score	*p*-value
Total	205	511	71.0	86.8	<0.001

Table 3
Number of times a topic was covered during cascade training and the number of healthcare workers trained per topic during cascade training.

Topic	Topic coverage during the cascade Frequency (Percentage)	Healthcare workers trained per topic Number (Percentage)
ABCDE Approach to a Patient	29 (21.2)	662 (18.6)
Approach to a Dyspnoeic Patient	7 (5.1)	142 (4.0)
COVID-19 case management	5 (3.6)	120 (3.4)
Documentation	5 (3.6)	144 (4.1)
EMS Regionalization agenda	11 (8.0)	298 (8.4)
Infection Prevention and Control	9 (6.6)	196 (5.5)
Oxygen Therapy	21 (15.3)	637 (17.9)
Patient flow and setting up an Emergency Unit	2 (1.5)	112 (3.2)
Patient referral and handover	5 (3.6)	132 (3.7)
Triage and the Uganda Triage and Treatment Algorithm	42 (31.4)	1107 (31.1)
Grand Total	137 (100.0)	3550 (100.0)

launched later in November 2021. The use of clinical protocols and checklists in clinical settings is reported to improve care processes and reduce mortality and morbidity [24].

A multidisciplinary team developed a curriculum that could be taught within two days during the COVID-19 outbreak. The curriculum was adapted from the standard WHO/ICRC BEC course from 5 days to 2 days because the MoH guidelines restricted gatherings during the outbreak. Also, most of the health workers were busy at the height of responding to the outbreak. The quality of the curriculum was assured by selecting modules from the standard BEC that were relevant to COVID-19 emergency care. The WHO/ICRC BEC has been widely used in Africa, and it has positively impacted the knowledge of healthcare workers trained [8,25–27]. Studies conducted in sub-Saharan Africa demonstrated long-term knowledge retention following BEC training [28], and the utility of the course in the management of COVID-19 patients [29].

Health workers trained as trainers subsequently trained seven times as many other health workers. This is a remarkable number given that this was delivered in the restrictive context of the COVID-19 outbreak and demonstrates the cascade model's utility in scaling technical capacity in low-resource settings. Indeed, the cascade model has been found to have the advantage of reaching a large number of trainees in a short period and being cost-effective when applied in the continuous professional development of teachers [16]. However, the curriculum was not fully delivered as the COVID-19 pandemic had implications for various aspects of operations, including support supervision. Introduction to UTAT, ABCDE approach to patient care and oxygen therapy were the most cascaded topics. These topics were crucial to the management of COVID-19 patients. The support supervision was largely remote. Other studies have reported challenges that hinder cascade in resource-limited settings including local conditions, lack of time and resources, inadequate facilities, and inadequate institutional support [19,30,31]. However, other training models have demonstrated great scalability in resource-limited settings, and these include tele-mentorship and the use of open-access educational resources [32–34].

Limitations

The limitations of this study include the lack of assessment of the knowledge gained by healthcare workers trained by the trainers during the cascade sessions. Additionally, while other studies have shown midterm knowledge retention following BEC training, our study did not include further knowledge assessment beyond the post-test. This absence of follow-up assessment may limit our understanding of the long-term effectiveness and retention of the training among participants.

Conclusion

The cascade mentoring approach had a positive impact on the level of knowledge the trainers trained. This demonstrates that leveraging a hierarchical training model facilitated the dissemination of knowledge in emergency care. The methods described can be replicated and adapted to the context of readers. Two critical gaps should be addressed: the inadequate fixed (non-rotating) staff at the ED and the lack of specialist doctors at the EDs of both general and referral hospitals through recruitment of these critical human resource personnel.

Dissemination of results

The preliminary results from the facility assessments were shared with respective regional teams as part of the regional training of trainers. All training reports were sent to the Uganda Ministry of Health.

CRediT authorship contribution statement

Sulaiman Bugosera Wasukira: Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Writing – review & editing, Visualization. **Carl Trevor Kambugu:** Conceptualization, Methodology, Formal analysis, Investigation, Writing – original draft, Writing – review & editing, Visualization. **Judith Nanyondo S:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing, Project administration, Funding acquisition, Supervision. **Emmanuel Candia:** Conceptualization, Methodology, Investigation, Writing – review & editing. **Stephen Emmanuel Aporu:** Conceptualization, Methodology, Investigation, Writing – review & editing. **Patricia Ikwaru:** Conceptualization, Methodology, Investigation, Writing – review & editing. **Racheal Kwagala:** Conceptualization, Methodology, Investigation, Writing – review & editing. **Andrew Kwiringira:** Formal analysis, Writing – review & editing, Visualization. **Peter Mukiibi:** Formal analysis, Writing – review & editing, Visualization. **Costance Murungi:** Formal analysis, Writing – review & editing, Visualization. **Marek Ma:** Writing – review & editing. **Celine Jacobs:** Conceptualization, Methodology, Investigation, Writing – review & editing. **Cliff Asher Aliga:** Conceptualization, Methodology, Investigation, Writing – review & editing. **Afizi Kibuuka:** Conceptualization, Methodology, Investigation, Writing – review & editing. **Dathan M. Byonanebye:** Writing – review & editing, Visualization. **Sylvia Natukunda:** Investigation, Writing – review & editing. **Kenneth Bagonza:** Conceptualization, Methodology, Investigation, Writing – review & editing. **Rose Muhindo:** Conceptualization, Methodology, Investigation, Writing – review & editing. **Prisca Kizito:** Conceptualization, Methodology, Investigation, Writing – review & editing. **Benard Toliva Opar:** Conceptualization, Methodology, Investigation, Writing – review & editing. **Nathan Kenya-Mugisha:** Conceptualization, Methodology, Investigation, Writing – review & editing. **Wilson Etolu:** Conceptualization, Methodology, Investigation, Writing – review & editing. **Paska Apiyo:** Conceptualization, Methodology, Investigation, Writing – review & editing. **Mohammed Larmode:** Conceptualization, Methodology, Writing – review & editing, Project administration, Funding acquisition, Supervision. **Joseph Oumo:** Conceptualization, Methodology, Investigation, Writing – review & editing. **Rony Bahatungire:** Conceptualization, Methodology, Investigation, Writing – review & editing. **John Baptist Waniaye:** Conceptualization, Methodology, Writing – review & editing, Project administration, Funding acquisition, Supervision. **Annet Alenyo-Ngabirano:** Conceptualization, Methodology, Writing – original draft, Writing – review & editing, Project administration, Funding acquisition, Supervision.

Declaration of competing interest

All the authors declare no conflict of interest.

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Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.afjem.2025.01.001.

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