

Current practices, challenges and enabling factors for electronic medical record implementation in Uganda: a convergent mixed- methods study

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Abstract

Background

Electronic medical records (EMRs) are critical for strengthening health service delivery in low- and middle-income countries, yet real-world adoption remains uneven. In Uganda, UgandaEMR+ covers only approximately 16.7% of health facilities, and even within deploying facilities, routine use is inconsistent. This study investigated current EMR practices, implementation challenges and enabling factors across four Ugandan health facilities to inform evidence-based strategies for sustainable scale-up.

Methods

A convergent mixed-methods design was used at four purposively selected facilities: Lira Regional Referral Hospital, Hoima Regional Referral Hospital, Kyangwali Health Centre IV, and Kawaala Health Centre IV. The quantitative strand surveyed 302 health workers using a structured questionnaire covering EMR use frequency, a 10-item perceived Challenges scale (CH1–CH10), and a 10-item perceived Facilitators scale (FA1–FA10). The qualitative strand comprised 10 semi-structured key-informant interviews and structured workflow observations. Quantitative data were analysed using descriptive statistics, chi-square (χ^2) tests, and multivariable binary logistic regression. Internal consistency was assessed using Cronbach's alpha ($\alpha = 0.84$ – 0.86). Qualitative data were analysed thematically with 20% double-coding.

Results

EMR use differed significantly across facilities ($\chi^2, p = 0.005$), with high-use proportions ranging from 29.6% at Kawaala HC IV to 60.0% at Kyangwali HC IV. Years of EMR experience was the strongest predictor of use ($p < 0.001$), while one-time formal training showed no significant association ($p = 0.465$). Perceived challenges were substantial (mean 3.56, SD 0.61); 75.2% of respondents reported moderate or high challenge levels. The most endorsed barriers were staff shortages at peak periods (CH7, 58.3%), time-consuming data entry (CH9, 58.3%), and duplicate documentation (CH5, 57.6%). Facilitating conditions were weak (mean 2.66, SD 0.85); reliable IT support (FA3) and peer-champion support (FA7) were most strongly absent. Qualitative interviews converged with these patterns, attributing them to hybrid paper–digital workflows, weak technical escalation, and inconsistent on-site support.

Conclusions

EMR implementation is shaped more by facility-level conditions and accumulated user experience than by one-time training. Priority strategies include treating power and connectivity as clinical safety

infrastructure, building responsive IT escalation pathways, aligning reporting workflows with EMR outputs, and shifting to continuous, workflow-embedded training.

Background

Achieving universal health coverage in sub-Saharan Africa depends in part on robust health information systems that can track patients, inform clinical decisions, and generate reliable routine data for planning and accountability [1]. Electronic medical records (EMRs) are a core component of such systems, yet their adoption trajectory in the region has been uneven, donor-fragmented, and largely concentrated within vertical HIV/AIDS treatment programmes rather than integrated into whole-facility service delivery [2, 3]. Understanding why EMRs remain variably adopted, even in facilities where the software has been installed, requires moving beyond technology-centric evaluations toward health-services research that examines the implementation environment in which these systems operate.

Uganda offers a particularly instructive case. The country's Ministry of Health, with support from the Monitoring, Evaluation and Technical Support (METS) programme at Makerere University, has developed UgandaEMR, an open-source EMR built on the OpenMRS platform [4]. The current generation, UgandaEMR+, is based on the OpenMRS 3 (O3) framework and features a modernised interface, improved interoperability with the national DHIS2 reporting system, and expanded clinical modules [5]. Despite this investment, coverage remains partial: by 2023, UgandaEMR was reported to be active in roughly 1,000 of Uganda's approximately 8,400 health facilities [6]. Critically, deployment does not guarantee routine use. Previous studies in Uganda and comparable settings have documented persistent parallel paper-based documentation, intermittent system use driven by power and connectivity disruptions, and a workforce with limited ongoing technical support [7, 8].

The existing literature identifies broad categories of barriers to EMR implementation in low- and middle-income countries (LMICs), including infrastructure deficits, staffing constraints, poor workflow alignment, and inadequate training [2, 9]. Conversely, enabling factors such as leadership engagement, peer-champion networks, adequate hardware, and alignment of EMR outputs with national reporting requirements have been associated with more successful implementations [10, 11]. However, much of this evidence derives from single-facility case reports, secondary literature reviews, or high-income-country contexts. There is a scarcity of primary, multi-site, mixed-methods studies that simultaneously quantify the prevalence and severity of specific barriers and facilitators while also capturing the qualitative mechanisms through which they operate in routine clinical practice [3].

To address this gap, we drew on the Non-adoption, Abandonment, Scale-up, Spread, and Sustainability (NASSS) framework [12] as a conceptual lens. NASSS identifies seven interacting domains, namely the condition or illness, the technology, the value proposition, the adopter system, the organisation, the wider institutional and societal context, and embedding and adaptation over time, that collectively determine whether a health technology moves from initial deployment to sustained routine use. By framing our

analysis within NASSS, we aimed to move beyond a checklist of barriers toward a sociotechnical understanding of why implementation succeeds or stalls under different facility-level conditions.

This study is part of a broader mixed-methods investigation of UgandaEMR+ implementation. A companion paper [17] reports on system usability using an adapted System Usability Scale. The present paper focuses on a different set of research questions: (1) What are the current EMR use practices across four Ugandan health facilities? (2) What are the key challenges affecting routine EMR implementation? (3) What enabling factors are present or absent, and what context-specific strategies can be proposed to improve EMR sustainability and scalability?

Methods

Overview of study design

We conducted a convergent mixed-methods study [13] in which a cross-sectional health-worker survey, semi-structured key-informant interviews (KIIs), and structured workflow observations were carried out concurrently at four health facilities in Uganda between March and May 2025. The quantitative and qualitative strands were analysed independently and then merged through a joint-display matrix organised by the three research objectives listed above. Full details of the shared study platform, including site selection rationale, sampling frame, and data-collection logistics, are described in the companion usability paper [17]; the present section summarises the elements relevant to the implementation-focused analyses reported here.

Setting and participants

Four public health facilities were purposively selected to maximise variation in facility level (regional referral hospital versus Health Centre IV), geographic and demographic context (urban Kampala, mid-western town, northern regional centre, and rural refugee-hosting), and duration of UgandaEMR+ deployment. The selected sites were Lira Regional Referral Hospital, Hoima Regional Referral Hospital, Kyangwali Health Centre IV, and Kawaala Health Centre IV. At each facility, health workers who had been employed for at least six months and who had direct or indirect interaction with the EMR were eligible. A stratified sample of 302 health workers, balanced across five cadre groups (clinical officers/doctors, nurses/midwives, laboratory technicians, pharmacy staff, and records/data officers), completed the structured questionnaire. For the qualitative strand, 10 key informants representing facility leadership, frontline clinicians, data officers, and national-level implementers were purposively recruited to capture a range of implementation perspectives.

Instruments

The structured questionnaire was developed specifically for this study (see Additional File 1 for the full English-language instrument). It was administered electronically via KoBoToolbox and comprised four sections: (a) sociodemographic and professional characteristics (age, gender, cadre, facility, years of EMR experience, formal training history); (b) EMR use frequency, measured as a single ordinal item and subsequently dichotomised into high use (daily or several-times-per-week) versus low use (rarely or never); (c) a 10-item perceived Challenges scale (CH1–CH10) scored on a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree), covering electricity instability (CH1), internet/network problems (CH2), insufficient hardware (CH3), system downtime (CH4), duplicate documentation workload (CH5), inadequate technical support (CH6), staff shortages at peak times (CH7), poor workflow fit (CH8), time-consuming data entry (CH9), and poor interoperability (CH10); and (d) a 10-item perceived Facilitators scale (FA1–FA10) on the same response format, covering leadership support (FA1), refresher training (FA2), reliable IT support (FA3), adequate devices (FA4), guidelines and SOPs (FA5), supervisor encouragement (FA6), peer-champion support (FA7), cross-department coordination (FA8), feedback mechanisms (FA9), and reporting–decision alignment (FA10). The instrument was pilot-tested at one of the study facilities and refined before full deployment. Internal consistency was assessed using Cronbach’s alpha ($\alpha = 0.86$ for Challenges; $\alpha = 0.84$ for Facilitators).

For the qualitative strand, a semi-structured interview guide (also included in Additional File 1) explored daily EMR use routines, perceived barriers, available support structures, and respondent-generated suggestions for improvement. Interviews lasted approximately 30 minutes and were audio-recorded with consent. Structured non-participant workflow observations were conducted in outpatient, maternity, laboratory, pharmacy, and records departments to document how UgandaEMR + was used in real time.

Analysis

Quantitative data were cleaned, coded, and analysed in two stages. Descriptive statistics (frequencies, proportions, means and standard deviations) characterised the sample and summarised composite and item-level scores for the Challenges and Facilitators scales. Composite scores were categorised as follows: Challenges, Low (mean < 3.0), Moderate ($3.0–3.9$), High (≥ 4.0); Facilitators, Low (< 2.5), Moderate ($2.5–3.4$), High (≥ 3.5). The lower Facilitators thresholds reflect the empirical observation that facilitator items attracted more conservative endorsement; a symmetric ≥ 4.0 cut-point would have produced a high-facilitator group too small ($< 10\%$) for meaningful bivariate analysis. Bivariate associations between respondent characteristics and EMR use category (high versus low) were tested with Pearson’s chi-square (χ^2). Independent predictors of high EMR use were identified through multivariable binary logistic regression, with results reported as adjusted odds ratios (AOR) and 95% confidence intervals.

Qualitative recordings were transcribed verbatim and analysed using reflexive thematic analysis. A 20% subset of transcripts was independently double-coded; inter-coder agreement was assessed using Cohen’s kappa (κ). Integration followed the joint-display approach: quantitative and qualitative findings

were arrayed side-by-side for each research objective, and meta-inferences were classified as convergent, complementary, or divergent [13].

Ethical considerations

The study was approved by the Busitema University Faculty of Health Sciences Research Ethics Committee (BUFHS-2025-97), a Uganda National Council for Science and Technology (UNCST)-accredited institutional review board with jurisdiction to review multi-site health research conducted across Uganda. Although no author is directly affiliated with Busitema University, the BUFHS-REC was selected because it is one of several nationally accredited RECs authorised by the UNCST to provide independent ethical oversight for investigator-initiated, multi-site studies in Uganda, irrespective of the investigators' home institution [14]. The study was conducted in accordance with the Declaration of Helsinki. All participants provided written informed consent prior to data collection. Collected data were de-identified and stored on encrypted, password-protected devices accessible only to the research team.

Use of AI tools

During the preparation of this manuscript, the authors used an AI language model (Anthropic model opus v4.6) for assistance with language editing. The authors reviewed and edited all AI-generated content and take full responsibility for the content of the publication.

Results

Respondent characteristics

A total of 302 health workers completed the survey across the four facilities: Lira RRH (n = 102, 33.8%), Hoima RRH (n = 76, 25.2%), Kyangwali HC IV (n = 70, 23.2%), and Kawaala HC IV (n = 54, 17.9%). The majority were female (57.3%), aged 36–60 years (76.5%), and nurses/midwives (40.1%). Notably, 43.7% reported zero years of EMR experience, and only 39.1% had received formal EMR training.

EMR use patterns and predictors

Respondents were classified as high EMR users (daily or several-times-per-week use; n = 132, 43.7%) or low EMR users (rarely or never; n = 170, 56.3%). EMR use differed significantly by facility (χ^2 , $p = 0.005$): Kyangwali HC IV had the highest proportion of high users (42/70, 60.0%), while Kawaala HC IV had the lowest (40/135, 29.6%). Years of EMR experience was the strongest predictor of use (χ^2 , $p < 0.001$): all 60 respondents with zero experience were low users (100%), while all 44 with 3–5 years of experience were high users (100%). One-time formal training showed no significant association with use category ($p = 0.465$). In the multivariable logistic regression model, facility and years of EMR experience remained the only significant independent predictors of high EMR use after adjusting for cadre, age group, and training status (Table 1).

Table 1
EMR use category by selected respondent characteristics (N = 302)

Characteristic	High use n (%)	Low use n (%)	χ^2 p-value
Facility			0.005
Lira RRH (n = 102)	50 (49.0)	52 (51.0)	
Hoima RRH (n = 76)	25 (32.9)	51 (67.1)	
Kyangwali HC IV (n = 70)	42 (60.0)	28 (40.0)	
Kawaala HC IV (n = 54)	15 (27.8)	39 (72.2)	
EMR experience (years)			< 0.001
0 years (n = 60)	0 (0.0)	60 (100.0)	
< 1 year (n = 88)	18 (20.5)	70 (79.5)	
1–2 years (n = 110)	70 (63.6)	40 (36.4)	
3–5 years (n = 44)	44 (100.0)	0 (0.0)	
Formal training received			0.465
Yes (n = 118)	54 (45.8)	64 (54.2)	
No (n = 184)	78 (42.4)	106 (57.6)	

Perceived challenges to EMR implementation

The Challenges scale demonstrated good internal consistency (Cronbach's $\alpha = 0.86$). The overall mean perceived challenges score was 3.56 (SD = 0.61, range 1.80–5.00), indicating substantial perceived barriers. When categorised, 75 (24.8%) respondents reported low challenge levels, 127 (42.1%) moderate, and 100 (33.1%) high, meaning 75.2% perceived at least moderate barriers to consistent EMR use.

Table 2
Item-level distribution of perceived challenges (CH1–CH10, N = 302)

Item (descriptor)	Mean (SD)	Disagree n (%)	Neutral n (%)	Agree n (%)
CH1 (Electricity instability)	3.46 (1.32)	83 (27.5)	67 (22.2)	152 (50.3)
CH2 (Internet/network)	3.50 (1.35)	80 (26.5)	60 (19.9)	162 (53.6)
CH3 (Insufficient hardware)	3.48 (1.33)	85 (28.1)	62 (20.5)	155 (51.3)
CH4 (Downtime/slow performance)	3.54 (1.30)	76 (25.2)	65 (21.5)	161 (53.3)
CH5 (Duplicate documentation)	3.62 (1.34)	74 (24.5)	54 (17.9)	174 (57.6)
CH6 (Inadequate tech support)	3.55 (1.36)	82 (27.2)	58 (19.2)	162 (53.6)
CH7 (Staff shortages/peak pressure)	3.64 (1.31)	70 (23.2)	56 (18.5)	176 (58.3)
CH8 (Poor workflow fit)	3.52 (1.35)	86 (28.5)	60 (19.9)	156 (51.7)
CH9 (Time-consuming data entry)	3.62 (1.33)	73 (24.2)	53 (17.5)	176 (58.3)
CH10 (Poor interoperability)	3.48 (1.37)	88 (29.1)	59 (19.5)	155 (51.3)

The three most frequently endorsed challenges were staff shortages during peak periods (CH7, 58.3%), time-consuming data entry (CH9, 58.3%), and duplicate documentation burden (CH5, 57.6%). These workload-related barriers dominated the challenge profile, suggesting that the primary implementation barrier is not the technology itself but the mismatch between EMR documentation requirements and existing workflow capacity (Table 2).

Perceived facilitators for EMR adoption

The Facilitators scale also demonstrated good internal consistency (Cronbach's $\alpha = 0.84$). The overall mean perceived facilitators score was 2.66 (SD = 0.85, range 1.00–5.00), indicating a weak facilitating environment. When categorised, 134 (44.4%) respondents fell into the low-facilitator group, 107 (35.4%) moderate, and only 61 (20.2%) high, meaning fewer than one in four respondents perceived a strong support environment for EMR use.

Table 3
Item-level distribution of perceived facilitators (FA1–FA10, N = 302)

Item (descriptor)	Mean (SD)	Disagree n (%)	Neutral n (%)	Agree n (%)
FA1 (Leadership support)	2.85 (1.28)	125 (41.4)	68 (22.5)	109 (36.1)
FA2 (Refresher training)	2.72 (1.30)	138 (45.7)	62 (20.5)	102 (33.8)
FA3 (Reliable IT support)	2.28 (1.22)	175 (57.9)	55 (18.2)	72 (23.8)
FA4 (Adequate computers/devices)	2.70 (1.32)	140 (46.4)	60 (19.9)	102 (33.8)
FA5 (Guidelines/SOPs)	2.78 (1.28)	132 (43.7)	64 (21.2)	106 (35.1)
FA6 (Supervisor encouragement)	2.75 (1.30)	136 (45.0)	62 (20.5)	104 (34.4)
FA7 (Peer champions/support)	2.22 (1.18)	180 (59.6)	52 (17.2)	70 (23.2)
FA8 (Cross-dept coordination)	2.68 (1.28)	142 (47.0)	60 (19.9)	100 (33.1)
FA9 (Feedback mechanisms)	2.72 (1.30)	138 (45.7)	58 (19.2)	106 (35.1)
FA10 (Reporting alignment)	2.80 (1.26)	130 (43.0)	66 (21.9)	106 (35.1)

The two most strongly absent facilitators were reliable IT support (FA3; 57.9% disagreed) and peer-champion support (FA7; 59.6% disagreed). These findings indicate a critical gap: the health workers most in need of responsive technical assistance and on-the-ground mentorship perceived these resources as largely unavailable (Table 3).

Qualitative findings

Thematic analysis of the 10 key-informant interviews and workflow observations identified four main themes that contextualised the quantitative findings:

Theme 1: Hybrid paper–digital workflows as the operational norm. Across all four facilities, health workers described a routine in which patient encounters were documented simultaneously in paper registers and UgandaEMR+. Interviewees explained that EMR outputs did not currently align with the reporting forms required by national programmes (e.g., HMIS 105), necessitating parallel documentation. Workflow observations confirmed that registration, outpatient, and maternity departments consistently operated dual systems.

Theme 2: Infrastructure fragility driving intermittent use. Power outages and network interruptions were described as the most immediate trigger for reverting to paper-only documentation. Health workers noted that when the system went down during a patient encounter, the entire clinical interaction had to be re-entered later, creating a backlog that discouraged subsequent EMR use. Kyangwali HC IV, which had a dedicated solar-powered backup, showed the highest routine use, consistent with its quantitative high-use profile.

Theme 3: Weak technical escalation and absent peer support. Interviewees consistently reported that when UgandaEMR+ encountered errors or slowdowns, there was no structured pathway for escalating the issue. Facility-level data officers were often the only technical resource, and their capacity to resolve system-level problems was limited. The absence of designated peer champions meant that less experienced staff had no on-site mentor for navigating the system.

Theme 4: Training as a one-time event, not a learning process. Multiple interviewees described formal EMR training as a single workshop delivered at deployment, with no structured follow-up. Staff who joined after the initial training, rotated between departments, or worked night shifts reported receiving no EMR orientation at all. This theme directly contextualises the quantitative finding that training was not associated with high use ($p = 0.465$): one-time training without reinforcement does not produce sustained adoption.

Integration of quantitative and qualitative findings

The joint-display matrix revealed predominantly convergent findings. The quantitative observation that facility-level conditions and accumulated experience drive EMR use was directly supported by qualitative accounts of infrastructure variation and the role of on-the-job learning. The quantitative finding that facilitators (especially IT support and peer-champion support) were weak was expanded by qualitative descriptions of absent escalation pathways. One notable complementary finding was that qualitative data explained the mechanism behind the training non-effect: training was typically delivered as a one-time event that did not address ongoing workflow evolution, staff turnover, or system updates. A minor divergence was noted in individual perceptions of training benefit: some interviewees described training as helpful, yet the adjusted model showed no protective association, suggesting that training quality and follow-up matter more than training receipt alone.

Discussion

This study provides a comprehensive, multi-site, mixed-methods assessment of EMR implementation in Uganda, spanning current practices, perceived challenges, facilitating conditions, and qualitative explanatory themes. The findings reveal an implementation environment where the EMR system is present but not yet embedded as trusted, routine clinical infrastructure. Three key insights deserve particular attention.

Implementation is shaped by facility ecology, not software alone

The significant facility-level variation in EMR use ($\chi^2, p = 0.005$) and the dominant role of accumulated experience ($p < 0.001$) indicate that adoption is driven by the local implementation environment rather than by the technology per se. This aligns with the NASSS framework's emphasis on the interaction between technology, adopter, and organisational domains [12]. Kyangwali HC IV, with solar-powered backup and longer deployment history, achieved 60% high use, while Kawaala HC IV, despite being urban,

achieved only 29.6%. Similar facility-level variation has been reported in Kenya's KenyaEMR deployment [4] and in a multi-country review by Jawhari et al. [2], suggesting that the pattern is not unique to Uganda but characteristic of LMIC EMR implementation more broadly.

Workload barriers dominate the challenge profile

The three most endorsed challenges, staff shortages during peak periods (CH7, 58.3%), time-consuming data entry (CH9, 58.3%), and duplicate documentation (CH5, 57.6%), all relate to workload rather than technology. This is consistent with global evidence that EMR implementation fails not because of poor software but because of inadequate attention to the workflow environment in which the software operates [2, 15]. The finding that 75.2% of respondents reported at least moderate challenge levels underscores the urgency of addressing these operational barriers before pursuing further scale-up. Notably, the qualitative data revealed that duplicate documentation persists because EMR outputs are not aligned with national reporting formats (e.g., HMIS 105), forcing parallel paper and digital entry. This suggests that a targeted policy intervention to align EMR reporting with HMIS requirements could eliminate a significant proportion of the perceived workload burden.

The facilitation gap: absent support, not absent motivation

The weak facilitator scores (mean 2.66, SD 0.85) and the finding that fewer than one in four respondents perceived a strong support environment reveal a critical gap. The two most strongly absent facilitators, reliable IT support (FA3, 57.9% disagreed) and peer-champion support (FA7, 59.6% disagreed), represent precisely the responsive, on-the-ground resources that the literature identifies as most important for sustaining EMR adoption [10, 11]. This finding parallels Kiberu et al.'s (2017) identification of limited technical support as a primary barrier to e-health in Uganda [8] and extends it by showing that the deficit persists even in facilities with active UgandaEMR+ deployments. The practical implication is that Uganda's EMR strategy should prioritise building responsive IT escalation pathways and peer-champion networks as implementation infrastructure, not as optional add-ons.

Training needs redesign, not just repetition

The absence of a significant association between formal training and high EMR use ($p = 0.465$), combined with the qualitative evidence that training was a one-time event with no follow-up, challenges the assumption that more training equals more use. Instead, the evidence suggests that Uganda's EMR capacity-building approach should shift from one-off workshops to continuous, workflow-embedded learning models, including peer mentorship, structured on-the-job coaching, and competency-based refresher modules tied to actual clinical tasks. This recommendation aligns with Greenhalgh et al.'s [12] NASSS domain of "embedding and adaptation over time," which emphasises that successful technology adoption requires ongoing organisational learning, not just initial deployment.

Limitations

This study has several limitations. First, the cross-sectional design captures a single time-point and cannot establish causal relationships between predictors and EMR use. Second, four purposively

selected facilities limit generalisability to the broader Ugandan health system; private, faith-based, and lower-tier (HC II/III) facilities were not included. Third, self-reported survey and interview data are subject to recall and social-desirability bias. Fourth, the Challenges and Facilitators scales, while demonstrating good internal consistency ($\alpha = 0.84\text{--}0.86$), have not been subjected to formal Exploratory or Confirmatory Factor Analysis; this is recommended as a priority for future psychometric work. Finally, routine system data (e.g., EMR logs, audit trails) were not analysed; complementary log-based studies would strengthen the evidence base.

Conclusions

Across four Ugandan health facilities, EMR implementation was uneven and shaped primarily by facility-level conditions and accumulated user experience rather than by one-time training events. The dominant barriers were workload-related (staff shortages, time-consuming data entry, duplicate documentation), while the most critical facilitator gaps were in responsive IT support and peer-champion networks. These findings point to four priority strategies for Uganda's national EMR scale-up: (1) treat power and connectivity as clinical safety infrastructure; (2) build responsive technical support with clear escalation pathways; (3) align reporting workflows with EMR outputs to eliminate duplicate documentation; and (4) shift from one-off training to continuous, workflow-embedded learning. Addressing these implementation ecology factors is essential for moving UgandaEMR+ from variable adoption toward sustainable, routine clinical use.

Abbreviations

EMR

Electronic Medical Record

LMIC

Low- and Middle-Income Country

HC IV

Health Centre IV

RRH

Regional Referral Hospital

KII

Key Informant Interview

DHIS2

District Health Information Software 2

HMIS

Health Management Information System

NASSS

Non-adoption, Abandonment, Scale-up, Spread, and Sustainability framework

AOR

Adjusted Odds Ratio

CI
Confidence Interval
SD
Standard Deviation
SOP
Standard Operating Procedure
O3
OpenMRS 3 platform
UNCST
Uganda National Council for Science and Technology
BUFHS-REC
Busitema University Faculty of Health Sciences Research Ethics Committee.

Declarations

Ethics approval and consent to participate: Ethical approval was obtained from the Busitema University Faculty of Health Sciences Research Ethics Committee (BUFHS-2025-97), a UNCST-accredited institutional review board with jurisdiction to review multi-site health research conducted across Uganda. The study was conducted in accordance with the Declaration of Helsinki. Written informed consent was obtained from all participants.

Consent for publication: Not applicable.

Availability of data and materials: The datasets used and analysed during the current study are available from the corresponding author on reasonable request. The study questionnaire and interview guide are provided as Additional File 1.

Competing interests: The authors declare that they have no competing interests.

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Authors' contributions: MM and NP conceived the study, designed the instruments, collected and analysed the data, and drafted the manuscript. DRX supervised the study and critically reviewed the manuscript. DW provided methodological guidance and reviewed the manuscript. All authors read and approved the final manuscript.

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