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Introducing enhanced recovery after surgery (ERAS) program in Rwanda: a step-by-step approach from KAP study to protocol development and preliminary implementation

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Abstract

Background Enhanced Recovery After Surgery (ERAS) programs improve postoperative outcomes through evidence-based practices. However, implementing ERAS in resource-limited settings like Rwanda remains challenging. This study aimed to introduce an ERAS program at the Centre Hospitalier Universitaire de Kigali (CHUK) by tailoring it to the local context.

Methods A multi-phase strategy was employed, beginning with a Knowledge, Attitudes, and Practices (KAP) study following an ERAS webinar to identify gaps in awareness and application of ERAS principles among perioperative care providers. Targeted training sessions were conducted to address these gaps, leading to the development of a locally adapted ERAS protocol.

Results The KAP study revealed limited awareness of ERAS protocols, including international Nil Per Os (NPO) guidelines, with only 45.7% of participants familiar with them and 48% unknowingly applying some ERAS elements. Early postoperative feeding was supported by 45.7%, and 92.5% agreed that preventing nausea and vomiting enhances recovery. Regarding opioid use, 88.4% supported selective use, while 81.5% disagreed with eliminating opioids entirely. Almost all respondents (97.7%) believed ERAS improved perioperative care, and 79.2% felt it reduced hospital expenses. Additionally, 85% of respondents recognized laparoscopic surgery as enhancing ERAS protocols. The insights gained informed the design of targeted training sessions and the development of a locally adapted ERAS protocol, supported by the formation of collaborative groups and ERAS champions.

Conclusion The introduction of ERAS at CHUK demonstrates the feasibility of implementing evidence-based surgical protocols in resource-limited settings. Addressing knowledge gaps and adapting protocols to the local context represent a promising step toward improving surgical care in Rwanda and enhancing perioperative management.

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Introduction

Enhanced Recovery After Surgery programs, first developed in Northern Europe, have transformed perioperative care by improving patient outcomes and speeding up recovery [1–3]. Introduced by Henrik Kehlet in the 1990s, ERAS protocols showed that patients undergoing major surgeries like open sigmoid resection could be discharged within two days postoperatively, compared to the traditional 10-day stay [4]. These protocols have since expanded globally, being implemented in over 25 countries, focusing on minimizing surgical stress through evidence-based perioperative strategies [4]. Core components of ERAS include preoperative optimization, minimally invasive surgery (MIS), multimodal analgesia, optimal fluid management, and early postoperative mobilization and nutrition [4–7]. Studies have shown these strategies reduce complications by 50%, shorten hospital stays, and provide both clinical and economic benefits [8–12].

In Rwanda, despite significant advancements in healthcare, perioperative care still faces challenges. Issues such as infrastructure constraints, inconsistent perioperative care standards, limited Intensive care unit (ICU) capacity, and suboptimal use of advanced medications present barriers to optimal surgical care. However, Rwanda's healthcare system, structured in a pyramidal model from community health workers to tertiary hospitals, is well-positioned for the integration of enhanced perioperative care strategies like ERAS, particularly with the introduction of Community-Based Health Insurance (CBHI) covering over 85% of the population and has a strong positive impact on access to health care [13, 14].

This study focused on the introduction of an ERAS program in Rwanda, adapted for the local context, with laparoscopic cholecystectomy as the targeted initial procedure. The program follows a stepwise approach, beginning with a Knowledge, Attitudes, and Practices (KAP) assessment of perioperative care providers, leading to targeted training, protocol adaptation, and pilot implementation. Through this process, the authors aimed to improve the quality of surgical care in Rwanda, providing both clinical and economic benefits, and laying the groundwork for nationwide implementation of ERAS protocols (Tables 1, 2, 3 and 4).

Methods

Study design

This study utilized a descriptive, multi-phase approach to introduce and develop a modified ERAS protocol at CHUK. The study consisted of an initial educational intervention, a knowledge assessment survey, targeted training sessions, and the development of a context-adapted ERAS protocol.

Study setting and population

The study was conducted at CHUK, a tertiary teaching hospital in Rwanda. The study population included perioperative care providers such as surgeons, anesthesiologists, non-physician anesthetists (NPAs), gynecologists, surgical residents, nurses, midwives, and clinical psychologists from CHUK. These healthcare professionals were involved in perioperative patient care and represented key stakeholders in ERAS implementation.

Intervention and procedures

The study was implemented in the following phases:

Educational webinar

A half-day webinar was organized in collaboration with the Departments of Surgery and Anesthesia to introduce ERAS principles to perioperative care providers. The webinar featured presentations by ERAS experts on key principles and challenges of implementation in low- and middle-income countries (LMICs), with a focus on laparoscopic surgery. This session facilitated discussions on ERAS adaptation in the Rwandan healthcare setting.

Knowledge, attitudes, and practices assessment

Following the webinar, a cross-sectional KAP study was conducted to assess perioperative care providers' understanding, perceptions, and current practices regarding ERAS. A structured online questionnaire was used, consisting of multiple-choice and open-ended questions covering demographic information, knowledge of ERAS principles, attitudes towards ERAS implementation, and current perioperative practices. Participation was voluntary, and data were anonymized.

Targeted training sessions

Based on the KAP survey findings, structured training sessions were developed to address identified knowledge gaps. These sessions focused on ERAS principles such as preoperative optimization, multimodal analgesia, fluid management, and early postoperative mobilization and nutrition. Training aimed to equip perioperative staff with the necessary skills to implement ERAS within the available resources at CHUK.

Table 1 Professional of study respondents

Characteristic	*n* (173)	%
Age		
< 30	9	5.2
30–40	87	50.3
> 40	77	44.5
Sex		
Female	134	77.5
Male	39	22.5
Education Level		
Diploma	76	43.9
Bachelor's Degree	75	43.4
Master's Degree	14	8.2
Residency	8	4.6
Profession		
Anesthesiologist	6	3.5
Gynecologist	4	2.3
Midwife	43	24.9
NPA	18	10.4
Nurse	89	51.4
Senior Resident	8	5.6
Surgeon	5	2.8
Work Experience	173	
< 5 years	29	16.8
5–10 years	32	18.5
> 10 years	112	64.8

NPA: None Physician Anesthetist

Table 2 Awareness and knowledge of ERAS guidelines

Variable	*N*	%
Aware of current international NPO guidelines		
Yes	110	63.6
No	63	36.4
Patients should take clear fluids 2 h before surgery		
Yes	72	41.6
No	101	58.4
Opioids should be avoided during and after surgery		
Yes	32	18.5
No	141	81.5
Opioids should be used selectively		
Yes	153	88.4
No	20	11.6
Early feeding should be encouraged after abdominal surgery		
Yes	79	45.7
No	94	54.3
Prevention of nausea and vomiting improves postoperative outcome		
Yes	160	92.5
No	13	7.5
Nausea and vomiting should be treated on patient request		
Yes	23	13.3
No	150	86.7

Table 3 Frequence of the application of ERAS protocol and laparoscopic surgery

Variable	*N*	%
Laparoscopic surgery improves ERAS protocol		
Yes	147	85.0
No	13	7.5
Don't know	13	7.5
Patient outcomes should be monitored routinely		
Yes	136	78.6
No	35	20.2
Don't know	2	1.2
Awareness of ERAS protocols		
Yes	79	45.7
No	94	54.3
Apply ERAS principles in daily practice		
Yes	83	48.0
No	90	52.0
Frequency of ERAS application		
< 50% of the time	96	55.5
50–75% of the time	53	30.6
> 75% of the time	24	13.8

Table 4 Respondents' views on the benefits of ERAS protocol

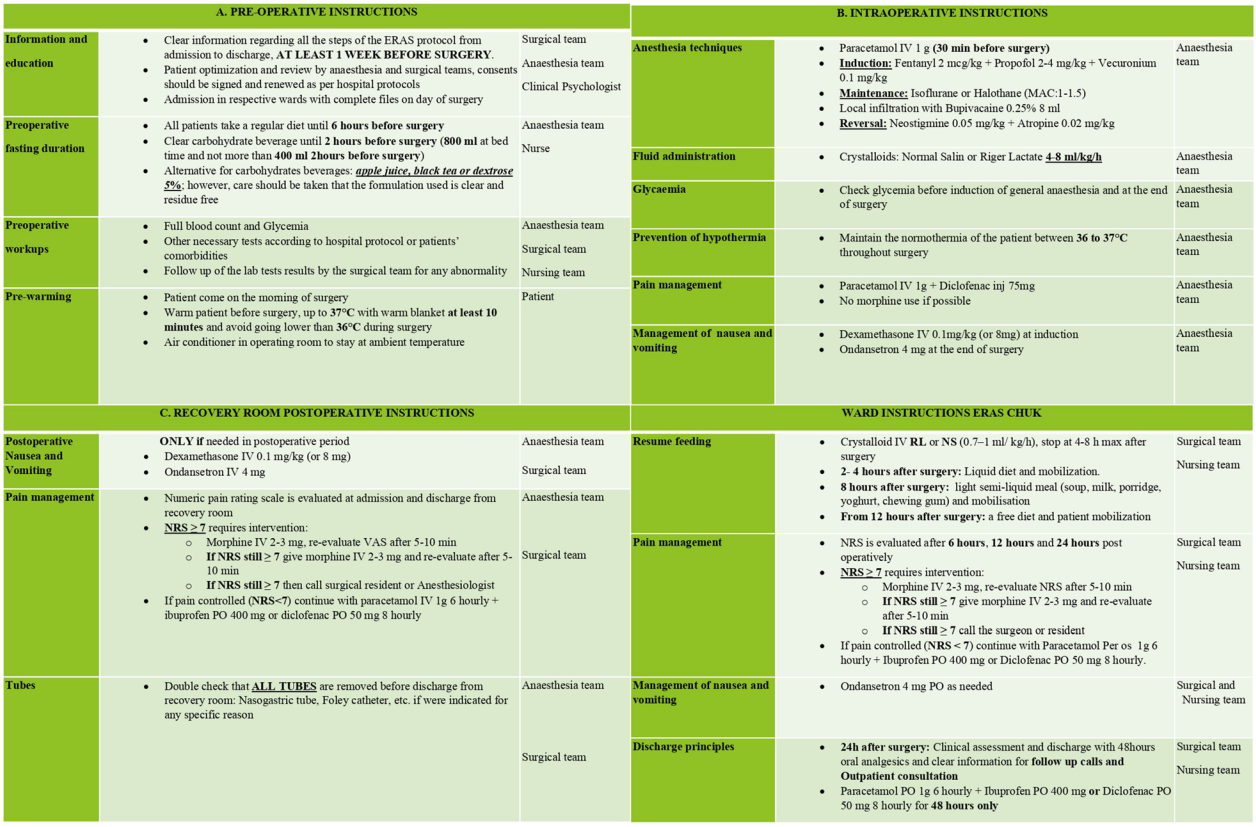
Variable	*n*	%
Can improve the standard of perioperative care	**173**	
Yes	169	97.7
No	3	1.7
Don't know	1	0.6
Multidisciplinary team for perioperative care is useful	**170**	
Yes	164	94.8
No	6	3.5
ERAS protocol reduces hospital expenses		
Yes	137	79.2
No	9	5.2
Don't know	27	15.6
ERAS protocol reduces patients' out-of-pocket expenses		
Yes	134	77.5
No	10	5.8
Don't know	29	16.8

Establishment of ERAS teams and champions

To ensure sustainable ERAS implementation, multidisciplinary ERAS teams were formed across various hospital wards. Departmental champions were appointed from surgery, anesthesia, and nursing to oversee ERAS adherence, provide ongoing education, and troubleshoot implementation challenges.

Development of the modified ERAS protocol

A multidisciplinary team, including surgeons, anesthesiologists, and nursing staff, collaborated to develop a modified ERAS protocol (Fig. 1) tailored to CHUK's clinical environment. The protocol was adapted from standard ERAS guidelines for colorectal surgery [15, 16], considering local constraints and available resources. Key



A. PRE-OPERATIVE INSTRUCTIONS		
Information and education	• Clear information regarding all the steps of the ERAS protocol from admission to discharge, **AT LEAST 1 WEEK BEFORE SURGERY**. • Patient optimization and review by anaesthesia and surgical teams, consents should be signed and renewed as per hospital protocols • Admission in respective wards with complete files on day of surgery	Surgical team Anaesthesia team Clinical Psychologist
Preoperative fasting duration	• All patients take a regular diet until **6 hours before surgery** • Clear carbohydrate beverage until **2 hours before surgery (800 ml** at bed time and not more than **400 ml 2hours before surgery**) • Alternative for carbohydrates beverages: ***apple juice, black tea or dextrose 5%***; however, care should be taken that the formulation used is clear and residue free	Anaesthesia team Nurse
Preoperative workups	• Full blood count and Glycemia • Other necessary tests according to hospital protocol or patients' comorbidities • Follow up of the lab tests results by the surgical team for any abnormality	Anaesthesia team Surgical team Nursing team
Pre-warming	• Patient come on the morning of surgery • Warm patient before surgery, up to **37°C** with warm blanket **at least 10 minutes** and avoid going lower than **36°C** during surgery • Air conditioner in operating room to stay at ambient temperature	Patient

B. INTRAOPERATIVE INSTRUCTIONS		
Anesthesia techniques	• Paracetamol IV 1 g **(30 min before surgery)** • **Induction:** Fentanyl 2 mcg/kg + Propofol 2-4 mg/kg + Vecuronium 0.1 mg/kg • **Maintenance:** Isoflurane or Halothane (MAC:1-1.5) • Local infiltration with Bupivacaine 0.25% 8 ml • **Reversal:** Neostigmine 0.05 mg/kg + Atropine 0.02 mg/kg	Anaesthesia team
Fluid administration	• Crystalloids: Normal Salin or Riger Lactate **4-8 ml/kg/h**	Anaesthesia team
Glycaemia	• Check glycemia before induction of general anaesthesia and at the end of surgery	Anaesthesia team
Prevention of hypothermia	• Maintain the normothermia of the patient between **36 to 37°C** throughout surgery	Anaesthesia team
Pain management	• Paracetamol IV 1g + Diclofenac inj 75mg • No morphine use if possible	Anaesthesia team
Management of nausea and vomiting	• Dexamethasone IV 0.1mg/kg (or 8mg) at induction • Ondansetron 4 mg at the end of surgery	Anaesthesia team

C. RECOVERY ROOM POSTOPERATIVE INSTRUCTIONS		
Postoperative Nausea and Vomiting	**ONLY if** needed in postoperative period • Dexamethasone IV 0.1 mg/kg (or 8 mg) • Ondansetron IV 4 mg	Anaesthesia team Surgical team
Pain management	• Numeric pain rating scale is evaluated at admission and discharge from recovery room • **NRS ≥ 7** requires intervention: o Morphine IV 2-3 mg, re-evaluate VAS after 5-10 min o **If NRS still ≥ 7** give morphine IV 2-3 mg and re-evaluate after 5-10 min o **If NRS still ≥ 7** then call surgical resident or Anesthesiologist • If pain controlled (**NRS<7**) continue with paracetamol IV 1g 6 hourly + ibuprofen PO 400 mg or diclofenac PO 50 mg 8 hourly	Anaesthesia team Surgical team
Tubes	• Double check that **ALL TUBES** are removed before discharge from recovery room: Nasogastric tube, Foley catheter, etc. if were indicated for any specific reason	Anaesthesia team Surgical team

WARD INSTRUCTIONS ERAS CHUK		
Resume feeding	• Crystalloid IV **RL** or **NS** (0.7–1 ml/ kg/h), stop at 4-8 h max after surgery • **2- 4 hours after surgery:** Liquid diet and mobilization. • **8 hours after surgery:** light semi-liquid meal (soup, milk, porridge, yoghurt, chewing gum) and mobilisation • **From 12 hours after surgery:** a free diet and patient mobilization	Surgical team Nursing team
Pain management	• NRS is evaluated after **6 hours**, **12 hours** and **24 hours** post operatively • **NRS ≥ 7** requires intervention: o Morphine IV 2-3 mg, re-evaluate NRS after 5-10 min o **If NRS still ≥ 7** give morphine IV 2-3 mg and re-evaluate after 5-10 min o **If NRS still ≥ 7** call the surgeon or resident • If pain controlled (**NRS < 7**) continue with Paracetamol Per os 1g 6 hourly + Ibuprofen PO 400 mg or Diclofenac PO 50 mg 8 hourly.	Surgical team Nursing team
Management of nausea and vomiting	• Ondansetron 4 mg PO as needed	Surgical and Nursing team
Discharge principles	• **24h after surgery:** Clinical assessment and discharge with 48hours oral analgesics and clear information for **follow up calls and Outpatient consultation** • Paracetamol PO 1g 6 hourly + Ibuprofen PO 400 mg **or** Diclofenac PO 50 mg 8 hourly for **48 hours only**	Surgical team Nursing team

Fig. 1 Modified ERAS pathway for laparoscopic cholecystectomy at the Centre Hospitalier Universitaire de Kigali, Kigali, Rwanda

modifications included the incorporation of multimodal analgesia strategies, a focus on minimizing unnecessary interventions (such as routine drains and tubes), and structured perioperative care pathways. The finalized protocol was reviewed and approved for integration into hospital practice.

Pilot implementation and evaluation

Although the pilot study results are not part of this study, their mention highlights that the developed ERAS protocol was successfully implemented, yielding promising outcomes. The findings supported the broader adoption of ERAS at CHUK, reinforcing its potential to improve surgical care beyond laparoscopic cholecystectomy. Key recommendations were made to ensure the program's sustainability, emphasizing continuous education, local adaptation, and multidisciplinary collaboration to address implementation challenges in resource-limited settings [17].

Data collection and analysis

Data from the KAP study were collected using an online survey platform and analyzed descriptively. No statistical comparisons were conducted, as the study aimed to identify broad knowledge trends and training needs rather than test hypotheses. Data were summarized using Microsoft Excel and presented as frequency distributions and thematic analyses for qualitative responses. Ethical approval was obtained from the CHUK ethic committee. Informed consent was secured from all participants involved in the study, including those who participated in the knowledge assessment survey and training sessions.

Results

Most respondents were aged between 30 and 40 years (50.3%), followed by those over 40 (44.5%), with only 5.2% aged 22–30. The gender distribution was predominantly female (77.5%), and 43.9% of the participants held a Diploma, while 43.4% had a bachelor's degree. Nurses formed the largest professional group (51.5%), with midwives comprising 24.9%. Most respondents had more than 10 years of work experience (64.8%).

Approximately 63.6% of respondents were aware of international NPO guidelines. However, knowledge about specific elements of ERAS protocols was inconsistent. While 88.4% supported selective opioid use during surgery, 81.5% disagreed with avoiding opioids entirely. Only 45.7% endorsed early feeding post-abdominal surgery, but 92.5% agreed that preventing nausea and vomiting improves postoperative outcomes.

Laparoscopic surgery was widely recognized as enhancing ERAS protocols (85%). Awareness of ERAS protocols was relatively low (45.7%), and only 48% of respondents reported applying ERAS principles in their daily practice. Application frequency varied, with 13.9% using ERAS principles more than 75% of the time, and 30.6% applying it 50–75% of the time.

Nearly all respondents (97.7%) believed that ERAS protocols could improve the standard of perioperative care, and 94.8% supported the use of multidisciplinary teams. Furthermore, 79.2% agreed that ERAS reduces hospital expenses, while 77.5% felt it decreases out-of-pocket costs for patients.

Discussion

The implementation of an Enhanced Recovery After Surgery (ERAS) program in a resource-limited setting such as Rwanda presents unique challenges and opportunities. This study demonstrates the feasibility of introducing an ERAS protocol at CHUK through a structured, stepwise approach involving knowledge assessment, targeted training, protocol adaptation, and pilot implementation.

Knowledge and perceptions of ERAS in Rwanda

The findings from our Knowledge, Attitudes, and Practices (KAP) study highlight both knowledge gaps and positive perceptions toward ERAS among perioperative care providers. A significant proportion of respondents (45.7%) were unfamiliar with ERAS principles, yet many unknowingly applied some ERAS elements in routine practice. Notably, the recognition of ERAS benefits was high, with 97.7% of respondents acknowledging its role in improving perioperative care and 79.2% perceiving a potential reduction in healthcare costs. The limited awareness of international Nil Per Os (NPO) guidelines and postoperative feeding recommendations aligns with previous studies in similar settings, underscoring the need for context-specific educational initiatives [18–20]. Addressing these gaps through structured training was a crucial step in the successful adaptation of ERAS principles to our local environment.

Protocol adaptation and implementation challenges

Developing a modified ERAS protocol required careful integration of evidence-based principles with the realities of a low-resource healthcare system. Key adaptations included:

1. A multimodal analgesia approach tailored to available medications.
2. Selective opioid use based on provider consensus, given the concerns surrounding opioid availability and overuse.
3. Emphasis on early oral feeding and mobilization, acknowledging cultural and institutional barriers to early postoperative recovery.
4. Strategic involvement of multidisciplinary ERAS teams and champions to oversee implementation.

The observed resistance to eliminating opioids entirely (81.5%) suggests that education on alternative analgesia strategies remains critical for the successful transition to opioid-sparing protocols [17, 21]. Furthermore, despite strong support for laparoscopic surgery (85%) as a facilitator of ERAS, infrastructural and training limitations remain key barriers to its widespread adoption in Rwanda.

Impact on perioperative care and patient outcomes

Our preliminary implementation of the modified ERAS protocol in laparoscopic cholecystectomy reported already [17], patients demonstrated promising trends in perioperative outcomes. Early mobilization and feeding were well tolerated, and no significant increase in complications was observed. While further data collection is necessary to quantify improvements in postoperative recovery and hospital stay duration, these initial findings suggest that ERAS is both feasible and beneficial in this setting. The establishment of ERAS groups and champions played a critical role in maintaining protocol adherence and addressing challenges in real-time, reinforcing the importance of a structured implementation framework.

Barriers to long-term implementation

Despite the promising results, several challenges must be addressed for long-term ERAS sustainability. Institutional resistance to change, variability in provider adherence, and resource limitations particularly regarding laparoscopy and multimodal analgesia pose ongoing obstacles. Additionally, patient-related factors, including cultural beliefs regarding perioperative fasting and postoperative pain management, require targeted education to enhance acceptance of ERAS principles. Future efforts should focus on continuous training, quality improvement initiatives, and advocacy for policy support to scale ERAS beyond laparoscopic cholecystectomy to other surgical procedures.

Studies in similar settings have shown the value of educational initiatives in encouraging the uptake of ERAS, even in resource-constrained environments [16]. Dr. Ravi Oodit and his team have similarly highlighted the importance of implementing ERAS in LMICs [22] and stressing the need for adapting perioperative programs like ERAS to improve surgical outcomes in low-resource settings, urging the global health community to make such tools more accessible and context-specific [22–24].

Limitations

This study has some limitations that should be considered. The study was limited to healthcare professionals at CHUK, which may restrict the generalizability of findings. Additionally, the questionnaire used consisted of a single-item question, which, while appropriate for the study's objectives, may have constrained the depth of responses. Additionally, an overview of the ERAS program and its principles was provided during a webinar session, which a small proportion of respondents attended. Given the limited number of attendees, we believe this factor did not significantly affect the overall findings. Despite these limitations, we are confident that the conclusions drawn from the study remain reliable.

Conclusion

This study represents a critical first step in the introduction of ERAS principles in Rwanda. By addressing knowledge gaps, adapting protocols to local constraints, and leveraging multidisciplinary collaboration, we have demonstrated that ERAS implementation is feasible even in resource-limited settings. Our findings suggest that a structured, educational approach can facilitate good adherence and adoption of ERAS program in a specific setting. However, ongoing evaluation and strategic investments in infrastructure and provider training are essential to ensure the sustainability and expansion of ERAS protocols in Rwanda. Future studies should focus on long-term patient outcomes, cost-effectiveness, and strategies for national implementation to further optimize surgical care in low- and middle-income countries.

Abbreviations

CBHI	Community-Based Health Insurance
CHUK	Centre Hospitalier Universitaire de Kigali
CMHS	College of Medicine and Health Sciences
EC	Ethics Committee
ERAS	Enhanced Recovery After Surgery
ICU	Intensive Care Unit
IRB	Institutional Review Board
KAP	Knowledge, Attitudes, and Practices
LMICs	Low- and Middle-Income Countries
MIS	Minimally Invasive Surgery
NPA	Non-Physician Anesthetist
NPO	Nil Per Os

Supplementary Information

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Supplementary Material 1

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Author contributions

M.N. created research idea, developed the protocol, supervised data collection, conducted data analysis, wrote the manuscript, and performed final revisions.M.G. developed the protocol, collected data, analysed data, and wrote some sections of the manuscript.E. M. developed the protocol and collected data.K.K. wrote the manuscript and reviewed the last version.P.B. refined the research idea and reviewed the manuscript text.J.T. analysed data, contributed to sections of the manuscript and prepared figure 1.J.G. provided guidance on study design and contributed significantly to manuscript editing.O.D. played a major role in the creation of the study concept, supervised the research process, and critically reviewed the manuscript for intellectual content.

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Data availability

The data generated and analyzed during this study are available from the corresponding author upon reasonable request.

Declarations

Ethics approval and consent to participate

This study was approved by the Institutional Review Board (IRB) of the University of Rwanda (Approval number: 412/CMHS IRB/2021) and the Ethics Committee of the University Teaching Hospital of Kigali (Approval number: EC/CHUK/1/074/2021). Informed consent was obtained from participants upon their agreement to complete the study questionnaire. The study adhered to institutional and national ethical standards and complied with the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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