



Exploring Laparoscopic Surgery Training Opportunities in the College of Surgeons of East, Central, and Southern Africa region

Martin Nyundo^{*}, Nathalie Umugwaneza^{*}, Abebe Bekele[†], Laston Chikoya[‡], Olivier Detry[§] and Julien Gashegu^{*,||}

^{*}Department of Surgery, University Teaching Hospital of Kigali, University of Rwanda, Kigali, Rwanda; [†]Department of Surgery, School of Medicine, University of Global Health Equity, Kigali, Rwanda; [‡]Department of Neurosurgery, Levy Mwanawasa Medical University, Lusaka, Zambia; [§]Department of Abdominal Surgery and Transplantation, CHU Liege, University of Liege, Liege, Belgium; and ^{||}Clinical Anatomy Department, University of Rwanda, Kigali, Rwanda

OBJECTIVE: The resource-limited environment in Sub-Saharan countries, with a lack of expert trainers, impedes the progress of laparoscopic training. This study aimed to identify the opportunities and limitations of laparoscopic surgery training in the College of Surgeons of East, Central, and Southern Africa (COSECSA) countries.

DESIGN AND SETTING: A multicountry online survey was conducted from January 2021 to October 2021 in COSECSA-accredited training hospitals within 16 countries. Available resources and challenges faced in order to set up well-structured laparoscopic training programs were explored.

RESULTS: Ninety-four surgeons answered the questionnaire. The average resources reported per hospital were 3 trained laparoscopic surgeons, 2 laparoscopic towers, and 2 sets of laparoscopic instruments. The training of the majority of these surgeons has been in local institutions (53%), a further 37% within African countries and only 10% outside Africa. Approximately 45% of them declared that laparoscopic modules were planned within the University Curricula, while only 18% of surgeons recognized that laparoscopic modules are only planned within the COSECSA program. About 57% of participants reported that at the end of residency training, graduating surgeons were not able to perform basic laparoscopic procedures. The quoted barriers included: limited laparoscopic

equipment, absence of simulation lab, lack of qualified trainers, lack of training programs and time for teaching by skilled doctors, and lack of institutional support.

CONCLUSIONS: The well-structured set up of laparoscopic training programs in the COSECSA region is hindered due to the lack of qualified personnel and insufficient resources for the acquisition of equipment and simulation laboratories. Ongoing efforts to set up laparoscopic programs through the development of adaptive curricula, innovative strategies for reduction of equipment cost and adequate training of surgeons are crucial for patient safety and the development of laparoscopy. (J Surg Ed 80:1454–1461. © 2023 Association of Program Directors in Surgery. Published by Elsevier Inc. All rights reserved.)

ABBREVIATIONS: LMIC, Low and middle-income countries COSECSA, College of Surgeons of East, Central and Southern Africa MCS, Membership of the College of Surgeons FCS, Fellowship of the College of Surgeons HIC, High-income country FLS Fundamentals of Laparoscopic Surgery

KEY WORDS: laparoscopic surgery, minimally invasive surgery, training, opportunities, limitations, Sub-Saharan Africa

COMPETENCIES: Medical Knowledge, Practice-Based Learning and Improvement

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Correspondence: Inquires to Martin Nyundo, MD, MMED, Department of Surgery, University Teaching Hospital of Kigali, University of Rwanda, KN 04 Avenue, 00250, Kigali, Rwanda; e-mail: nyundomartin@gmail.com

INTRODUCTION

It has been demonstrated that access to surgical care in Sub-Saharan Africa is limited by many factors such as

transport, infrastructure, geography, culture, and finances.¹ The insufficient number of qualified healthcare professionals also remains a major issue, particularly in modern approaches such as laparoscopy.^{1,2} The main advantages of the laparoscopic approach have been documented in many clinical trials.³ In low and middle-income countries (LMICs) it has been reported that laparoscopy may be associated with a significant reduction in postoperative wound infection rate, shorter hospital stay and faster recovery, when compared to open surgery.⁴⁻⁸

Laparoscopy has brought new educational challenges to ensure that surgeons are adequately trained to provide its benefits in a safe environment. The College of Surgeons of East, Central, and Southern Africa (COSECSA) is a professional organization, founded in 1999, that fosters surgical education and training. The college currently includes 139 accredited hospitals in 14 Sub-Saharan countries: Botswana, Burundi, Ethiopia, Kenya, Malawi, Mozambique, Namibia, Rwanda, South Sudan, Sudan, Tanzania, Uganda, Zambia, and Zimbabwe. The mission of COSECSA is to increase the accessibility of surgical services, especially to the rural populations of Africa, by standardizing and widening access to surgical training, skills and knowledge with a mandate to advance the science and practice of surgery in the region.⁹ There are 2 training systems for surgeons in the COSECSA region. The first is based within the universities and trains postgraduate students in a variety of surgical specialties through a Master of Medicine program. The second system, established by COSECSA, oversees accredited training programs in several hospitals and includes 2 years of basic surgical skills from the Membership of the College of Surgeons (MCS) and a following 3 years from the Fellowship of the College of Surgeons (FCS). The laparoscopic surgery modules are integrated into the teaching curricula of some universities and the modules are elective in the COSECSA program.

Mastering laparoscopy and its training is an exciting challenge for the next generation of surgeons in Sub-Saharan Africa.^{10,11} Currently and in the majority of situations, the main model for developing a laparoscopy program in LMICs is that of partnering with a surgical program in a high-income country (HIC) that facilitates staff training, equipment purchase, and development of clinical guidelines.^{4,5,7,12-15} This model still leads to expectable challenges. Programs offering intermittent clinical support in LMICs may result in inadequate training and program discontinuation after course has been completed if a sustainability plan has not been designed.^{4,5,7,12,16}

The aim of this study was to identify the opportunities for and limitations of training in laparoscopic surgery in the COSECSA countries, to provide recommendations to

strengthen laparoscopic surgical education and to improve the quality and safety of laparoscopic practice in this Sub-Saharan region.

MATERIAL AND METHODS

Research Method and Setting

This was a cross-sectional study based on the expertise of healthcare professionals. The authors conducted a multinational survey from January 2021 to October 2021 using a structured questionnaire containing numerical scoring and close-ended questions. Open-ended questions were asked to reveal the resource capacity and limitations for the teaching of laparoscopic surgery in their universities and hospitals. The questionnaire was distributed to surgeons in different COSECSA-accredited training hospitals using an online survey form. Implied consent was obtained from all the study participants when they registered on the web-based survey. The COSECSA Institutional Review Board (IRB) approved this study (IRB Registration Number: 00011122).

Data Collection

Questions focused on the training capacity of the hospitals including qualified staff, equipment, instruments, surgical activities, in addition to curriculum and teaching methods, in laparoscopic surgery. The opportunities and limitations were identified in order to fully implement the laparoscopic training program in the respective Universities and hospitals.

Data Analysis

Data were recorded using Microsoft Excel spreadsheets and exported to International Business Machines (IBM) Statistical Product and Service Solutions (SPSS) software platform version 25 for analysis. Descriptive data were used to generate frequencies and percentages for categorical variables. The median and interquartile range (IQR) were used to describe the central tendency and dispersion of continuous data, respectively.

RESULTS

Demographic Characteristics

Ninety-four surgeons from 16 countries replied to the questionnaire. The East and Central African countries accounted for 75.4% while Southern African countries represented 24.6%. **Table 1** shows that the majority of responders were practicing in public hospitals (n = 66, 70.2%) including 46.8% in university teaching hospitals and 39.4% in referral hospitals. The majority were

TABLE 1. Hospital and Professional Profile of the Participants

	n	%
Hospital ownership		
Public	66	70.2
Private	21	22.3
NGO	7	7.4
Hospital type		
District/provincial Hospital	13	13.9
Referral Hospital	37	39.4
University Teaching Hospital	44	46.8
Administrative position		
Hospital manager	3	3.2
Clinical director	4	4.3
Program coordinator	18	19.1
Head of department	23	24.5
None of the above	52	55.3
Specialty		
General surgery and subspecialties	75	79.7
Pediatric surgery	7	7.4
Urology	12	12.8
Clinical position		
Chief consultant	13	13.8
Senior consultant	15	16
Consultant	28	29.8
Junior consultant	19	20.2
Surgical trainee	19	20.2

NGO, Nongovernmental organization.

general surgeons (79.7%), and other specialties included urology (n = 12, 12.8%) and pediatric surgery (n = 7, 7.4%). The participants who occupied a managerial position accounted for 40%, and approximately 20% of responders were surgical trainees.

Surgical Volume and Hospital Capacity for the Laparoscopic Surgery Training in the COSECSA Region

On average the hospitals each had 3 surgeons practicing laparoscopic surgery, 2 laparoscopic towers, and 2 sets of laparoscopic instruments. A median of 10 laparoscopic procedures per month was reported (Table 2). Generally, surgeons who performed laparoscopic procedures declared that they had been trained locally (53%), while 37% had been trained in African countries and only 10% had been trained outside Africa (Fig. 1).

Teaching Capacity and Teaching Methods

Almost 43.6% (41/94) of participants indicated that modules were actually planned within universities, while only 35.1% (33/94) of participants declared that these modules are actually taught. In the case of the COSECSA program, 28.7% (27/94) of participants recognized that the modules were really planned in the curriculum, while 18% (17/94) of participants declared that the modules were planned and taught, and only 8.5% (8/94) of

TABLE 2. Hospital Capacity and Surgical Volume Per COSECSA Affiliated Hospital

	Minimum	Q1	Median	Q3
Performed laparoscopic procedures	1	4	10	20
Laparoscopic towers	1	1	2	3
Laparoscopic instrument sets	1	1	2	3
Trained laparoscopic surgeons	1	2	3	4

participants declared that the modules were taught during clinical rotations of the trainees even if they had not been planned in the COSECSA program. Considering the teaching methods of laparoscopic surgery, Table 3 shows that 4 key teaching methods were used, including workshops (68.1%), lectures (53.2%), simulations (53.2%) and videos (34%). The dry laboratory was the most commonly used type of simulation (57.6%) (Table 3) while the wet lab was used by 1.1% and the cadaver was never employed in laparoscopic training in the region (Table 3).

Laparoscopic Teaching Program Model and Trainee Learning Process

About 57% of participants answered that, in their view, at the end of residency training, the graduating surgeons were not able to perform basic laparoscopic procedures. In addition, 55.3% of participants said that in formal training, the trainee should be exposed to basic laparoscopic skills throughout their education, starting from year 1. About 95% of the participants declared that there was an urgent need to implement well-structured laparoscopic surgery training programs in their own country. However, they confirmed that the best way of achieving this would be by integrating laparoscopic training into

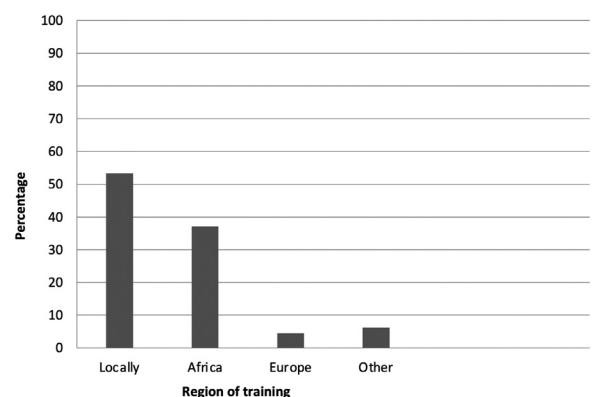
**FIGURE 1.** Training region for surgeons in laparoscopic surgery.

TABLE 3. Teaching Capacity and Teaching Methods of Laparoscopic Surgery in the University and COSECSA Hospitals

	n	%
Teaching methods of laparoscopic surgery		
Workshops	64	68.1
Lectures	50	53.2
Simulations	50	53.2
Videos	32	34
Cadaver	0	0
None	12	12.8
Simulation Lab type		
Dry lab	53	57.6
Virtual simulation	10	10.9
Wet lab	1	1.1
None	28	30.4

existing COSECSA and university curricula, without it being a stand-alone program (Table 4).

Barriers to Proper Training in Laparoscopic Surgery

Figure 2 shows the perceived barriers that prevent the proper training of laparoscopic surgery in COSECSA

TABLE 4. Laparoscopic Teaching Program Model and Trainee Learning Process

	n	%
Do you think that at the end of residency training in your hospital, the graduated surgeon is able to perform basic laparoscopic procedures?		
No	53	57
Yes	40	43
When do you think that residents in surgery should be exposed to basic laparoscopic surgical skills?		
Throughout their training starting from year 1	52	55.3
Second year	13	13.8
Third year	13	13.8
First year	10	10.6
Fourth year	5	5.3
Final year	1	1.1
Do you think that it is important to have formal laparoscopic surgery training in your country?		
No	5	5.3
Yes	89	94.7
What is the best way of developing and promoting laparoscopic surgery in your country?		
Integrated program into the existing programs without a standalone program	81	86.2
COSECSA fellowship in laparoscopic surgery	37	39.4
University training degree in laparoscopic surgery	24	25.5

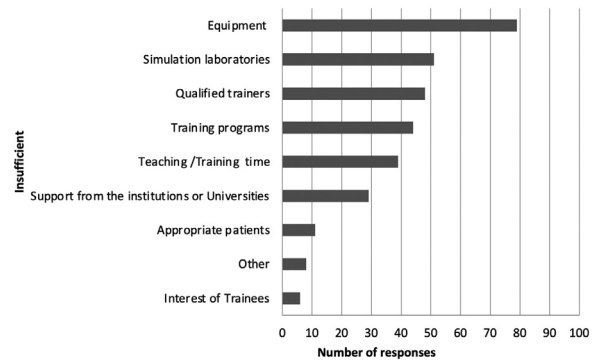


FIGURE 2. Barriers to proper training in laparoscopic surgery in COSECSA countries.

region. The 5 most highly cited obstacles were limited laparoscopic equipment (n = 79, 84%), lack of simulation lab (n = 51, 54.3%), lack of qualified trainers (n = 48, 51%), lack of training program (n = 44, 46.8%) and time for teaching by skilled doctors (n = 39, 41.5%), respectively. In addition, the receiving support from institutions, either the hospitals or universities, has been found to be a significant challenge. Consequently, participants suggested that in setting up proper training in laparoscopic surgery in the COSECSA region, special attention should be paid to the availability of equipment and consumables, increasing the number of trainers, developing formal laparoscopy training programs and simulation laboratories, and establishing serious leadership involvement (Table 5).

DISCUSSION

The advent of laparoscopic surgery has caused a model shift in surgical practice. Conditions requiring surgical care account for an estimated 20% of the global burden of disease, but unfortunately the delivery of surgical services within sub-Saharan Africa is challenging.¹⁷⁻¹⁹ However, there is a rising trend to develop surgical treatment in LMICs²⁰⁻²² with laparoscopic surgery playing an

TABLE 5. Aspects Needed to Improve Training in Laparoscopic Surgery

Aspects needed to improve training in laparoscopic surgery	n	%
Equipment and consumables	59	71.1
Number of trainers	40	48.2
Formal training program	28	33.7
Simulation laboratory	23	27.7
Hospital leadership and support	6	7.2
Other	7	8.4

important role. As surgical culture and behavior have been reported as having an impact on the introduction and progress of new technology, a mind shift regarding laparoscopic surgery and other new surgical techniques needs to be encouraged in Sub-Saharan countries in order to improve the current situation. The aim of this study was to identify the opportunities for and limitations of laparoscopic surgical education in the COSECSA region. This multicountry survey demonstrates that COSECSA-accredited hospitals have basic and insufficient resource teaching capacity for the implementation of the laparoscopic surgery training programs, despite being willing to embrace this new technology. **Figure 2** shows the 5 perceived barriers that prevent the proper training of laparoscopic surgery in the COSECSA region: 1) limited laparoscopic equipment, 2) lack of simulation labs, 3) lack of qualified trainers, 4) lack of training programs and 5) limited time for teaching by skilled doctors. In addition, this study identified the fact that gaining the support of the institutions, either hospitals or universities, as an important challenge. Therefore, the laparoscopic volume reported in this study was very low, 10 laparoscopic procedures per month per hospital, which becomes another barrier to laparoscopic training.

All but 2 COSECSA countries were represented in this survey and the majority of responders were working in teaching or referral hospitals and with managerial positions. This made the study population of great interest as most surgeons are trained in university teaching and referral hospitals. The fact that the responders to the survey were in senior positions increased the accuracy and relevance of the information collected, as they are the ones who deal with the day-to-day situations, are familiar with the system, but are also able to come up with the appropriate strategies to resolve any issues. However, in Africa, the practice of laparoscopic surgery is not sufficient in teaching hospitals. For example, Afuwape et al. reported that only a few therapeutic laparoscopic surgery procedures are performed in Nigerian teaching hospitals on an annual basis.²³

A short supply of sufficiently skilled laparoscopic surgeons and limited of equipment have been cited as barriers in this study. Laparoscopy programs are complex and require initial and sustained investments, including high levels of human capital, equipment, technical facilities and finances.^{4-6,24,25} Farrow et al. also found that poor access to training, laparoscopic equipment, equipment maintenance, and consumables were among the obstacles barring access to laparoscopy in developing countries.²⁶ Others studies have reported that the lack of resources and education are only 2 of the potentially numerous challenges in the complex problem of the adoption of laparoscopic surgery in LMICs.^{27,28} The

findings from this present study found that the majority of surgeons who performed laparoscopic procedures have been trained locally and in African countries, with only a small minority undergoing training in Europe and North America. In certain LMICs visiting surgeons, and some nationals who have relocated from HICs, work on the expansion and further development of laparoscopic surgery. Moreover, as part of their continuing professional development, some surgeons from LMICs travel to centers in the United States and Europe to gain further laparoscopic experience.²⁹

The data from this survey revealed that the teaching of modules of laparoscopic surgery in the universities and COSECSA countries is not well structured, hardly a few of the surveyed surgeons recognized that the modules are planned and taught during clinical rotations and the teaching methods used include workshops, lectures, simulations and videos while the use of a wet lab is scarce. It has been reported that laparoscopy is not taught in postgraduate programs in several LMICs because simulation laboratories are not readily available. This is due to the high cost of the equipment and the lack of animal or cadaver laboratories.³⁰ Laparoscopy is not suited to the old surgical mantra of “see one, do one, teach one.” Under this traditional model some local surgeons in LMICs have acquired and developed laparoscopic abilities in an unstructured way. This approach potentially teaches unsafe practices to surgeons in training.³⁰ The training programs should be structured to include lectures and workshops rather than just short-term courses. Global connectivity through technology can also facilitate teaching and training methods with the development of Google glasses, Facetime, and Skype, for example, which permit communication, consultation, and feedback.³⁰

From our findings it appears that the majority of graduating surgeons are not able to perform basic laparoscopic procedures. Additionally, participants thought that to have good acquisition skills the trainees should be exposed to basic laparoscopic skills throughout their education from the beginning of their surgical training. Therefore, it is important to set up a structured model where the trainee will take part to simulation exercises outside away from the operating room. The participants showed an urgent need to implement well-structured laparoscopic surgery training and to integrate it into existing COSECSA and university curricula. In response to this perceived need for more advanced training within residency, the afore-mentioned FLS was created. Its cognitive content, manual skills training, and assessment were formalized, standardized, and then disseminated via a national curriculum.³¹

Limited laparoscopic equipment, lack of laparoscopic simulation labs, lack of qualified and motivated

laparoscopic trainers, fewer laparoscopic procedures, clack of training laparoscopic program, and lack of leadership involvement were found to be the barriers for the proper set up of laparoscopic surgery training in COSECSA region. The resource-limited setting in LMICs hinders the progress of laparoscopic training, with the scarcity of expert mentors.³⁰ Innovative measures have been developed to counteract the simulation problem with low fidelity but effective trainers. Resourceful laparoscopic trainers using simple technology at a low cost have emerged from both LMICs and HICs. Home laparoscopic trainers have been made from recyclable materials such as storage and shoe boxes.^{30,32} Simulation-based training, even with inexpensive equipment, requires an investment in time and sustainability.³³ Using materials sourced locally is key to the success of making affordable laparoscopic training tools.³⁰ The recording of common and basic procedures such as appendectomies and cholecystectomies for teaching and training purposes is considerably underutilized in both LMICs and HICs.³⁰ This can allow all the team in the operating room, including trainees, to understand the processes involved in these laparoscopic operations.³⁰ Internet access can also facilitate learning as a number of movies of laparoscopic procedures are freely available online. Curricular can facilitate the learning of laparoscopic skills in LMICs using low cost trainers and these need to be developed.³⁰ Zadey et al. have developed a low-cost laparoscope called KeyScope and a lift retractor called KeyLoop, collectively referred to as KeySuite. It has been designed for the challenges and needs of LMICs,³⁴ while lift laparoscopy has been documented for performing cholecystectomies and appendectomies in LMICs.³⁵ KeyScope has been bench-tested against the standard laparoscope and was found to have noninferior image quality and illumination with a comparable field of view, depth, resolving power, lens distortion, and color reproduction accuracy.³⁶ The global economic picture for better healthcare should include the manufacture of robust, durable, and affordable surgical instruments that can be used by LMICs.³⁰

Limitations

The accuracy of the answers could not be verified as the survey was conducted online. Two COSECSA countries were not represented in our study, notably Sudan and South Sudan; conversely, some East African community countries were over-represented, undoubtedly due to the geographic location of the principal investigator. However, the authors limited this bias by presenting the results as median, as the responses were not symmetrically distributed.

CONCLUSION

Laparoscopic surgery requires extensive experience. When performed safely it offers better results in comparison to open surgery. At a present time, 20 years after the introduction of these procedures, there is still a need for training opportunities at all levels.^{37,38} However, in the COSECSA region it remains difficult to set up laparoscopic training programs due to the lack of qualified personnel and insufficient financial resources for the acquisition of equipment and the simulation laboratories. Ongoing efforts to overcome these limitations through the efforts of the surgeons, the development of structured programs and innovative measures, and the adequate training of surgical trainees, are crucial for patient safety. Improving laparoscopic training could lead to an increase in the number of laparoscopic cases and reduce the learning curve of trainees, which is a primary goal of imparting skills. The training and practice of laparoscopic surgery in Sub Saharan Africa could be improved and made more broadly available through postgraduate medical education.

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