



Original Article

Which Laparoscopic Surgery Training Model for Sub-Saharan Africa? The Hands-On Approach of the Belgian ARES 2016-Training Curriculum in Cameroon

*Quel modèle de formation en chirurgie laparoscopique pour l'Afrique subsaharienne ?
L'approche pratique du cursus de formation belge ARES 2016 au Cameroun*

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HIGHLIGHTS

What is already known on this topic

- Box training before operating room practice has already been demonstrated as the norm for laparoscopy training.
- Hands-on on the spot training of laparoscopic surgery has been tried in other African countries

What the study adds

- Publications on laparoscopic training in Sub Saharan Africa are highly limited.
- Available trainings have short duration trainings, with few having a longer (2 years) span of training like ours.

ABSTRACT

Minimal invasive surgery, first introduced in Cameroon in 1992, offers several advantages over open surgery but is not routinely taught during surgical training in developing countries. The European Academy for Gynecological Surgery uses the Laparoscopic Skills Testing and Training method which prepares learners via exercises which serve as a 'green card' to move to the operating room. In developing countries these complex training systems are often unavailable. A hands-on approach in skills acquisition gives learners the opportunity to learn, apply and practice new skills in a safe environment. A Masters in Laparoscopic Surgery is currently offered by the University of Douala, partnering with Université Libre de Bruxelles supported by the Belgian Government through (Académie de Recherche et l'Enseignement Supérieur) in an attempt to bridge this gap. The training lasts two years with 04 theoretical/simulation sessions in the simulation laboratory during the first year, and four practical sessions in three practicing hospitals in the second year. Overall, 13 doctors were trained in the first batch and at the end were able to perform routine surgeries via laparoscopy and set up practice in distant locations. Training another batch will vulgarize minimal invasive surgery and improve the quality of care in our hospitals. Other countries like Rwanda now use this model.

RÉSUMÉ

La chirurgie mini-invasive, introduite pour la première fois au Cameroun en 1992, offre plusieurs avantages par rapport à la chirurgie classique mais cette dernière n'est pas systématiquement enseignée pendant la formation en technique chirurgicale dans les pays en voie de développement. L'Académie européenne de chirurgie gynécologique utilise des méthodes de formation et des tests de compétence laparoscopique qui préparent les apprenants au travers des exercices servant de « feu vert » pour l'admission au bloc opératoire. Dans les pays en voie de développement, ces systèmes de formation complexes sont souvent indisponibles. Une approche pratique basée sur l'acquisition de compétences donne aux apprenants la possibilité d'apprendre, et de mettre en pratique de nouvelles compétences en toute sécurité. Un master en chirurgie laparoscopique est actuellement proposé par l'Université de Douala au Cameroun, en partenariat avec l'Université Libre de Bruxelles soutenu par le gouvernement belge à travers l'Académie de Recherche et l'Enseignement Supérieur dans le but de combler ce vide. La formation dure 02 ans au cours desquelles 04 séances théoriques sont programmées dans un laboratoire de simulation pendant la première année et 4 séances pratiques dans les hôpitaux d'application durant la 2e année de formation. Au total, 13 médecins ont été formés et ont été capables d'effectuer des chirurgies de routine par laparoscopie, et de les mettre en application dans des zones reculées. La formation d'autres promotions vulgarisera la chirurgie mini-invasive et améliorera la qualité des soins dans nos hôpitaux. Des pays comme le Rwanda utilisent déjà ce modèle.

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INTRODUCTION

The advantages of minimal invasive surgery over open surgery are numerous. These include, non-distortion of anatomic planes during surgery, little tissue damage hence reduced long term risk of post-operative adhesions, shortened hospital stay, reduced duration of post-operative analgesia, early resumption of activities for patients, and the social, psychological and economic benefits of rapid recovery [1]. The introduction of laparoscopic techniques in general surgery led to many unnecessary complications, hence the development of skills laboratories to train novice laparoscopic surgeons[2]. The adage “see one, learn one, do one” generally applied to general surgery hardly applies to laparoscopic surgery, which has a longer learning curve[3]. In addition to the general skills needed for open surgery (dexterity, knowledge of anatomy, pathology and surgical techniques), laparoscopy also demands specific laparoscopic psychomotor skills due to the absence of a three dimensional view and the ‘keyhole’ nature of the surgery [4]. Current training involves the use of box trainers with either inanimate models or animal tissues. The European Academy for Gynecological Surgery uses the Laparoscopic Skills Testing and Training (LASTT) method which prepares learners with some exercises which serve as a ‘green card’ to move to the operating room [4]. Some authors have argued that inanimate models lack objective assessment of skill acquisition and that using dexterity-based and video analysis system can make objective assessment possible[2]. In developing countries these complex training systems are often unavailable. A hands-on approach in skills acquisition gives learners the opportunity to not only learn but to apply and practice new skills in a safe environment. Hands-on training is an effective format for laparoscopic skills in which two-hand coordination is vital[5]. In Cameroon, a Masters in Laparoscopic Surgery is currently offered by the

University of Douala, thanks to a partnership with Université Libre de Bruxelles (ULB) supported by the Belgian Government through ARES (Académie de Recherche et l’Enseignement Supérieur) in an attempt to bridge this gap. This write up details the training model and share our experience on laparoscopy training in a low resource setting, and showcase the standout particularities of this model. The objective of this study is to present a training model for laparoscopy which can be reproduced in other low- and middle-income countries.

MATERIALS AND METHODS

We describe herein how the selection and training of the candidates took place:

- **Selection criteria:** candidates had to be a surgeon (general, digestive or urologist) or Gynecologist with at least a two-year professional experience.
- **Duration of training:** two-year training with no simultaneous batches concomitantly.

- **Trainers:** Université Libre de Bruxelles’ surgeons, Cameroonian surgeons in the Diaspora and Cameroonian based laparoscopic Surgeons.
- **Site of training:** Theoretical courses and simulations in the University of Douala campus, and practical sessions in three hospitals: Douala Gyneco-Obstetrics and Pediatric Hospital DGOPH), General Hospital of Douala (GHD), and the Laquintinie Hospital of Douala (LHD).
- **Course Type:** Competency-based approach:
 - Competence 1:* Communication skills to obtain consent from patient/family
 - Competence 2:* Master Surgical indications and Patient care strategies.
 - Competence 3:* Correct use of Laparoscopy equipment.
 - Competence 4:* Perform Surgeries.
 - Competence 5:* Master Ensure immediate and remote post-operative care.
 - Competence 6:* Develop team work and multi-disciplinary approach to patient care.
 - Competence 7:* Perform duties while respecting ethics, the law, and good practices.
 - Competence 8:* Improve Medical practice.
- **Sessions:** there were a total of 8 sessions, 4 theoretical and 4 practical each lasting 2 weeks.
- **Evaluation:** A mid-course evaluation was done after the first year of training (4 courses) and a final certification evaluation at the end of the 8 sessions. The final evaluation consisted on, a written exam, evaluation of the student’s portfolio, appreciation of clinical ability by all the trainers, and a case presentation in front of a jury.
- **Sponsors:** The 02 main sponsors are ARES, funded by the Belgian government, and MEDTRONICS, a medical equipment firm which donated equipment for box trainers and laparoscopic equipment for hospital internship. We also had logistic support from the 02 universities and the 03 partner hospitals.

Outline of the training

The lectures were on the principles of endoscopic surgery, the parts and functioning of laparoscopic equipment; common malfunctions of equipment and remedies; handling of laparoscopic equipment; ergonomics in laparoscopy; laparoscopic instruments; patient installation with respect to different procedures; principles of electro surgery; patient safety; surgical complications of laparoscopic surgery; ethics and deontology; team building; patient-doctor relationship; the specificities and complications of anesthesiology in laparoscopic surgery. Some specific lectures were given with respect to specialties (hysteroscopy for gynecologists and cystoscopy for urologists).

The 5th to 8th session was reserved for clinical application of the theoretical knowledge and skills acquired from the lab.

The autonomy of the trainees was progressive. Patient selection was done 6 to 8 weeks to the practical sessions (except for emergency cases) which lasted 2 weeks, with cases from all 03 internship sites. First, they passively

observed surgeries performed by the coaches; then they assisted the coaches; then trainee operated with the assistance of the coaches; next the trainees operated and assisted each other with the coach on the surgical field; finally, the trainees operated with the coach guiding out of the operating field. At any moment when the trainee was the main surgeon the coach could take over the surgery if it became difficult or the patient's life was deemed to be in danger. An end of course evaluation was done through an internship portfolio and a clinical case in which all 8 competences were demonstrated.

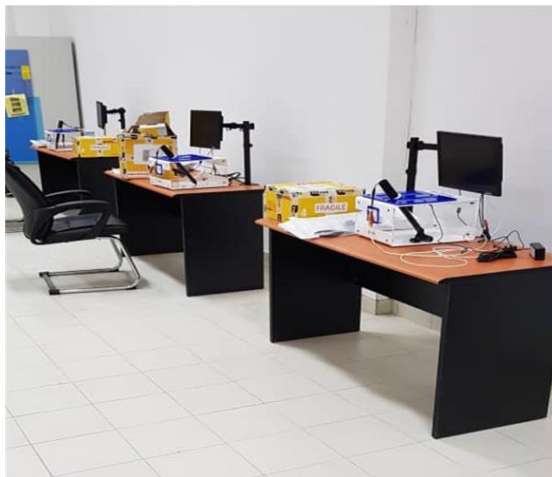


Figure 1 : Simulation lab



Figure 2: training exercises

RESULTS

A total of 17 trainees completed the first four sessions with evaluation of mid-way training of theoretical knowledge, Laparoscopic psychomotor skills in box trainer, and portfolios. All 17 trainees succeeded.

14 trainees successful underwent the clinical training and 13 succeed in the final evaluation (09 gynecologists, 03 general surgeons, and 01 urologist) which involved clinical evaluation. 01 candidate was not awarded an attestation pending additional clinical internship. Ten scrub nurses were trained alongside the Masters students to help in running the laparoscopic units of the graduates.

Figure 1 to 4 show the number and types of surgeries performed during the clinical internships:

More than half of the surgeries performed were gynecologic, most likely due to the fact that the bulk of the trainees were gynecologist.

The most common gynecologic procedures were related to infertility (Figure 2).

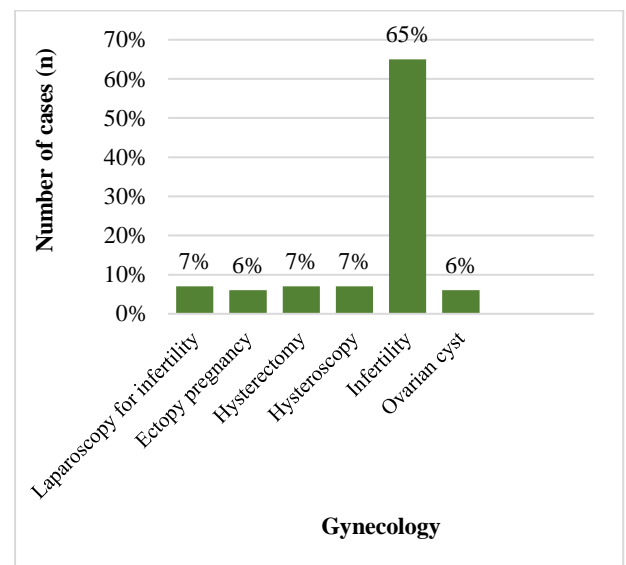


Figure 2 : Distribution of gynecologic interventions

The figure 3 demonstrate that cholecystectomies and hernia repairs were the most frequent.

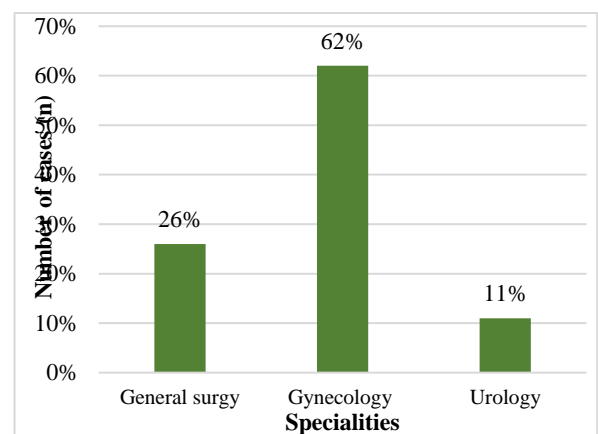


Figure 1 : Type of surgical interventions

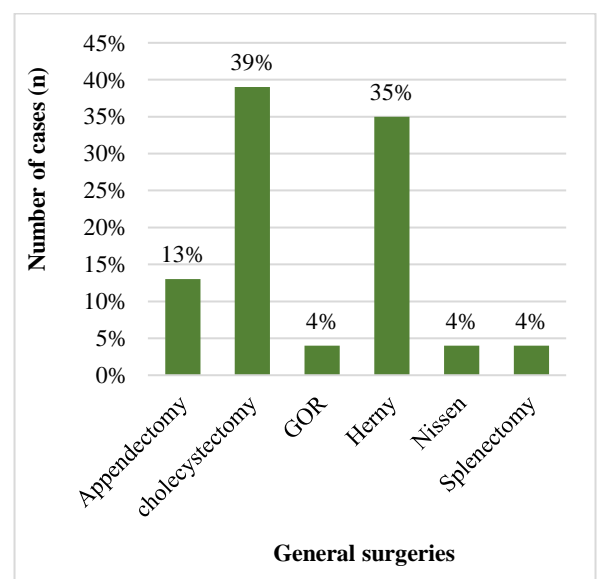
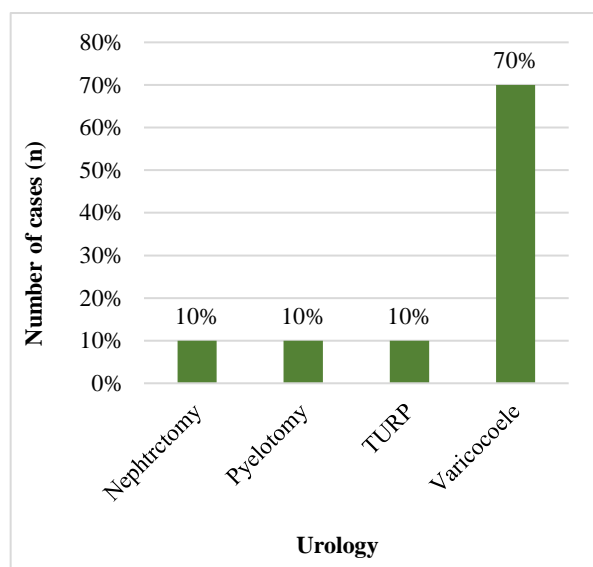
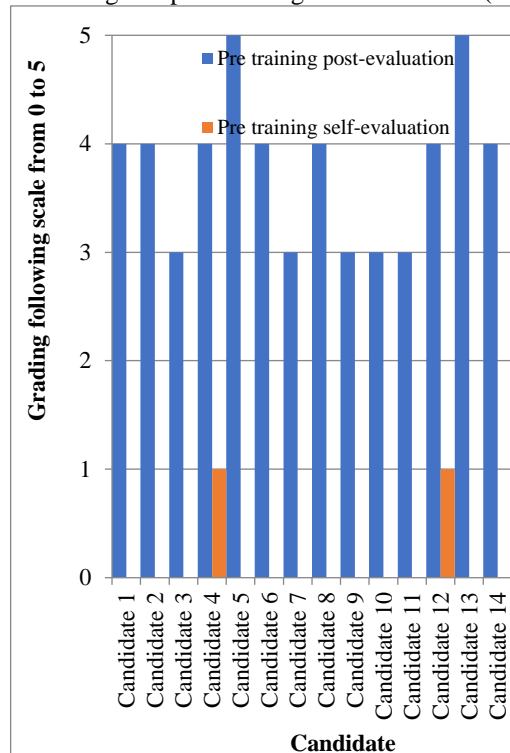


Figure 3 : Gastro intestinal surgery

Varicocoele repair represented the most performed surgery in urology (Figure 4)

**Figure 4** : Urologic surgery

Pre training and post training self-evaluation. (Figure 5)

**Figure 5** : Pre training and post training self-evaluation.

Most of the participants evaluated at the beginning of the training their level in laparoscopy close to zero. At the end of the training, the self-assessment was close to 5/5 for all the participants.

All the surgeons felt they had acquired baseline knowledge and competence in laparoscopic surgery with

respect to the most commonly encountered pathologies. Three laparoscopic units have been created and are functional. One in the North regional hospital, one in the District hospital of Cite de palmier and in Nkongsamba regional hospital in the Littoral region with Surgeries performed by the graduates of the first batch and scrub nurses. The advances made in minimal invasive surgery at the Douala Gyneco-Obstetrics and Pediatric Hospital (one of many beneficiary facilities), have been published [6].

The simulation lab in the faculty is functional and accessible to trainees or graduates to improve on their psychomotor skills.

This same training model is currently being implemented in Rwanda, and the trainers include two graduates of the first batch of Cameroon.

DISCUSSION

Laparoscopic surgery was first introduced in the general hospital of Yaoundé, Cameroon, in April 1992 as a collaborative effort between the University of Clermont-Ferrand and the University of Yaoundé [7]. Since then, very limited health facilities perform minimal invasive surgery in Cameroon, with only about 7 percent of overall surgeries being done by laparoscopy in those centers [8]. The number of available laparoscopic surgeons are also limited as Minimal Invasive Surgery (MIS) is not routinely taught during residency in Developing countries like Cameroon.

This study aims at presenting a minimal invasive surgery training model in developing countries.

A review of the literature did not find our exact model of training, especially in low resource countries. We however, realized that other Low- and middle-income countries have tried different training models, mostly via short courses.

In Tanzania, efficient training in MIS has been done using low-cost box trainers for surgery residents and Surgeons with participants achieving impressive posttest scores after a three-month training period [9].

Okraïne et al. also demonstrated in Botswana, a middle-income country, that teaching a Fundamentals in laparoscopic Surgery (FLS) course via simulation during a 3-day surgical skills training course was feasible and significantly improved FLS technical skills [10].

Helen Wilkinson described, in her study on barriers to MIS training in LMICs identified the following: funding; availability and maintenance of equipment; local access to experienced laparoscopic trainers; stakeholder dynamics; lack of knowledge on effective training curricula; surgical departmental structure and practical opportunities for trainees. Our training model resolved most of the problems raised. In effect, a well-organized curriculum, access to simulation labs, and the input from experienced trainers are some strong points of our training model worth mentioning [11].

In a Survey carried out among South African Surgeons, APOSTOLOU and PANIERI found out that lack of equipment, theatre time constraints and finally lack of encouragement from seniors were the most significant hurdles to laparoscopic training [12].

Long-term continuous on-site training with clinical collaboration has been shown to be effective in implementing laparoscopic surgery in low resource settings as demonstrated in Ghana by kang and all [13].

In developed countries on the other hand, MIS training models are centered around virtual reality simulators and animal models, which are relatively expensive, though they have proven efficiency. Furthermore, laparoscopic training is part of the curriculum during surgical training from junior levels [14].

Not many articles have been published on MIS training models in Sub Saharan Africa, most likely due to the low percentage occupied by MIS among the surgical techniques practiced in this part of the world.

Strengths of the training model

1. The training was tailored to adapt to the local working conditions and pathologies. Laparoscopic surgeons from Low- and Middle-Income Countries (LMIC) trained in Developed countries, who return to practice may not find the working conditions similar to the training conditions and face difficulties in settling in and eventually lose the skills acquired [15]. The ideal situation therefore will be for surgeons in LMIC to be trained on the spot, with the means available, and with familiar pathologies, while at the same time benefiting from the training models of developed countries.
2. Our trainees (Belgians and Belgian trained Cameroonians practicing overseas) flew in to Cameroon for training which was logistically easier and less costly easier than sending 17 trainees to Belgium.
3. A baseline reference document of Skills/competences was used for assessment. This innovative approach kept the trainees focused at each period It also enabled them to continuously measure their improvements in specific competences as the training evolved.
4. An implementation project for laparoscopic surgery was required by the graduates at end of training and measures taken to ensure setting up of functional laparoscopic units. This not only ensures that the patient population benefits from the expertise of the trained surgeons, but with will ensure that the competences acquired are sustained.
5. Seven graduates of the first batch have been included in team of trainers and
 - a. coaches for the 2nd batch.
6. Concerning the sustainability of the training, a third batch of 18 trainees is currently being trained.

Avenues for improvement

Reduction in number and duration of theoretical sessions. This is most important for trainees who don't have prior exposure to laparoscopic towers to speed up skills acquisition. The theoretical sessions can be concomitantly done with the practical sessions given the trainees are established surgeons who have already a certain background knowledge.

Improve diversity in the types of surgical procedures and pathologies.

Perspectives

The University system, in collaboration with Cameroonian hospitals should in the long be autonomous in running the training program.

Improve the simulation lab with possibilities of life animal surgeries and 3D video simulations.

A society of laparoscopic surgeons has been created in order to improve surgical performance, promote skills sharing and improve research and its 1st congress is currently being planned.

Limitations

The report presents the application of the training model for the first batch only. Thus, limiting the sample size in terms of eliminating selection bias.

CONCLUSION

This project enabled the training of 14 doctors of 03 different surgical specialties in laparoscopic surgery. The admission of a second batch is vulgarizing the practice of MIS and improve the quality of care in our hospitals. We believe that in the years to come, improvements will be made to improve on the shortcomings of the training in order to facilitate skills acquisition and meet up with known international norms. This however must be adapted to the local realities and be constantly improved as the need arises. Other Sub-Saharan countries can be inspired by this training model.

COMPETING INTERESTS

The authors declare no competing interests.

AUTHORS' CONTRIBUTIONS

Inna Rakya, Neng Humphry Tatah, Basile Essola designed the study and wrote the protocol; Clovis Ourtchingh, Augustin LINGBA, Jacques Landennes, and Robert Tchounzou participated in patients recruitment. Inna Rakya wrote the manuscript, JB Ebimbe assisted in data entry and statistical analysis, Jacob Souopgui, Basile Essola, corrected the manuscript. Emile Mboudou, Charlotte TCHENTE supervised the manuscript writing. All the authors approved the final version

REFERENCES

1. Murray A, Lourenco T, de Verteuil R, Hernandez R, Fraser C, McKinley A, et al. Clinical effectiveness and cost-effectiveness of laparoscopic surgery for colorectal cancer: systematic reviews and economic evaluation. *Health Technol Assess.* nov 2006;10(45):1-141, iii-iv.
2. Aggarwal R, Moorthy K, Darzi A. Laparoscopic skills training and assessment. *Br J Surg.* déc 2004;91(12):1549-58.
3. Subramonian K, Muir G. The 'learning curve' in surgery: what is it, how do we measure it and can we influence it? *BJU International.* 2004;93(9):1173-4.
4. Campo R, Wattiez A, Wilde RLD, Sanabria CRM. Training in laparoscopic surgery: From the lab to the or. *Slovenian Journal of Public Health.* 1 oct 2012;51(4):285-98.
5. Mori T, Hatano N, Maruyama S, Atomi Y. Significance of « hands-on training » in laparoscopic surgery. *Surg Endosc.* mars 1998;12(3):256-60.
6. Neng H, Ngalame A, Rakya I, Lingba A, Ebimbe J, Souopgui J, et al. MINIMAL INVASIVE SURGERY

- (MIS) ARES 2016-TRAINING CURRICULUM PROGRAM IN CAMEROON: ASSESSING ITS APPLICATION IN GYNAECOLOGY TWO YEARS AFTER IMPLEMENTATION AT DGOPH. 2020;8(8):14.
7. Raiga J, Kasia JM, Bruhat MA. Laparoscopic surgery in the Cameroon. *Int J Gynaecol Obstet.* avr 1999;65(1):65-6.
 8. Mboudou E, Morfaw FL, Foumane P, Sama JD, Mbatsogo BAE, Minkande JZ. Gynaecological laparoscopic surgery: eight years experience in the Yaoundé Gynaeco-Obstetric and Paediatric Hospital, Cameroon. *Trop Doct.* 1 avr 2014;44(2):71-6.
 9. Beard JH, Akoko L, Mwanga A, Mkony C, O'Sullivan P. Manual Laparoscopic Skills Development Using a Low-Cost Trainer Box in Tanzania. *Journal of Surgical Education.* 1 janv 2014;71(1):85-90.
 10. Okrainec A, Smith L, Azzie G. Surgical simulation in Africa: the feasibility and impact of a 3-day fundamentals of laparoscopic surgery course. *Surgical endoscopy.* 2009;23(11):2493-8.
 11. Wilkinson E, Aruparayil N, Gnanaraj J, Brown J, Jayne D. Barriers to training in laparoscopic surgery in low- and middle-income countries: A systematic review. *Trop Doct.* juill 2021;51(3):408-14.
 12. Apostolou C, Panieri E. National survey of surgeons' attitudes to laparoscopic surgical training in South Africa. *S Afr J Surg.* août 2007;45(3):86, 88, 90-1.
 13. Kang MJ, Apea-Kubi KB, Apea-Kubi KAK, Adoula NG, Odonkor JNN, Ogoe AK. Establishing a Sustainable Training Program for Laparoscopy in Resource-Limited Settings: Experience in Ghana. *Ann Glob Health.* 30 juill 2020;86(1):89.
 14. Shetty S, Zevin B, Grantcharov TP, Roberts KE, Duffy AJ. Perceptions, training experiences, and preferences of surgical residents toward laparoscopic simulation training: a resident survey. *J Surg Educ.* 2014;71(5):727-33.
 15. Alfa-Wali M, Osaghae S. Practice, training and safety of laparoscopic surgery in low and middle-income countries. *World J Gastrointest Surg.* 27 janv 2017;9(1):13-8.