

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/269794296>

Minor Gynecologic Surgery: A Review of the Training Experience and Skill Building Opportunities for Providers in Low and Middle Income Countries

Article in *Open Journal of Obstetrics and Gynecology* · January 2014

DOI: 10.4236/ojog.2014.47064

CITATION

1

READS

637

7 authors, including:



Rachel M Clark
Partners HealthCare

80 PUBLICATIONS 869 CITATIONS

SEE PROFILE



Jessica Opoku-Anane
University of California, San Francisco

41 PUBLICATIONS 232 CITATIONS

SEE PROFILE



Joseph Ngonzi
Mbarara University of Science & Technology (MUST)

88 PUBLICATIONS 1,271 CITATIONS

SEE PROFILE



Mithila Faruque
Bangladesh University of Health Sciences

66 PUBLICATIONS 2,275 CITATIONS

SEE PROFILE

Some of the authors of this publication are also working on these related projects:



Implementing WHO PEN intervention model in reducing hypertension, diabetes and their risk factors in a rural community in Bangladesh [View project](#)



Salt Intake & Cardiovascular Risk among Bangladeshi Population [View project](#)

2014

Minor gynecologic surgery: A review of the training experience and skill building opportunities for providers in low and middle income countries

Rachel Marie Clark

Massachusetts General Hospital, Boston, MA

Leslie Siriya Bradford

University of Massachusetts Medical School Worcester

Jessica Opoku-Anane

George Washington University

Joseph Ngonzi

Mbarara University of Science and Technology, Mbarara, Uganda

Ferdous Islam

Dhaka Medical College Hospital, Dhaka, Bangladesh

See next page for additional authors

Follow this and additional works at: http://hsrc.himmelfarb.gwu.edu/smhs_obgyn_facpubs

 Part of the [Obstetrics and Gynecology Commons](#)

Recommended Citation

Clark, R.M., Bradford, R.S., Opoku-Anane, J., Ngonzi, J., Islam, F. et al. (2014). Minor gynecologic surgery: A review of the training experience and skill building opportunities for providers in low and middle income countries. *Open Journal of Obstetrics and Gynecology*, 4(7), 432-444.

This Journal Article is brought to you for free and open access by the Obstetrics and Gynecology at Health Sciences Research Commons. It has been accepted for inclusion in Obstetrics and Gynecology Faculty Publications by an authorized administrator of Health Sciences Research Commons. For more information, please contact hsrc@gwu.edu.

Authors

Rachel Marie Clark, Leslie Siriya Bradford, Jessica Opoku-Anane, Joseph Ngonzi, Ferdous Islam, Mithila Faruque, and Annekathryn Goodman

Minor Gynecologic Surgery: A Review of the Training Experience and Skill Building Opportunities for Providers in Low and Middle Income Countries

Rachel Marie Clark¹, Leslie Siriya Bradford², Jessica Opoku-Anane³, Joseph Ngonzi⁴, Ferdous Islam⁵, Mithila Faruque⁶, Annkathryn Goodman^{1*}

¹Department of Obstetrics and Gynecology, Division of Gynecology Oncology, Massachusetts General Hospital, Boston, USA

²Department of Obstetrics and Gynecology, Division of Gynecology Oncology, University of Massachusetts, Worcester, USA

³Department of Obstetrics and Gynecology, George Washington University Hospital, Washington, D.C., USA

⁴Department of Obstetrics and Gynecology, Mbarara University Teaching Hospital, Mbarara, Uganda

⁵Department of Obstetrics and Gynecology, Dhaka Medical College Hospital, Dhaka, Bangladesh

⁶Department of Obstetrics and Gynecology, Birdem Hospital, Dhaka, Bangladesh

Email: [*agoodman@partners.org](mailto:agoodman@partners.org)

Received 13 April 2014; revised 18 May 2014; accepted 24 May 2014

Copyright © 2014 by authors and Scientific Research Publishing Inc.

This work is licensed under the Creative Commons Attribution International License (CC BY).

<http://creativecommons.org/licenses/by/4.0/>



Open Access

Abstract

Purpose: Minor gynecologic surgery is the cornerstone of gynecologic evaluation and intervention in countries with a well-established medical infrastructure. Surgical training and exposure to minor procedures are not available in low and middle-income countries due to the complex challenges of patient delay and lack of access to healthcare, physician shortages, and the lack of ancillary services such as pathology and radiology. This paper reviews current training statistics, the international literature on minor gynecologic surgery and training strategies. **Methods:** PubMed searches using MESH terms cone biopsy, dilation and curettage, and loop electrosurgical excision procedure were performed. Statistics of minor surgical procedures among US Obstetrics and Gynecology Residency programs were tabulated. We then searched for data of training programs and surgical statistics in low resource countries. **Results:** Dilation and curettage is the most common minor gynecologic procedure in the United States but is performed with significantly lower frequency in low and middle-income countries. The most common procedure for the treatment of preinvasive disease was cryotherapy followed by loop electrosurgical excision procedure. There was no information about minor surgical procedures performed in hospitals in

*Corresponding author.

How to cite this paper: Clark, R.M., *et al.* (2014) Minor Gynecologic Surgery: A Review of the Training Experience and Skill Building Opportunities for Providers in Low and Middle Income Countries. *Open Journal of Obstetrics and Gynecology*, 4, 432-444. <http://dx.doi.org/10.4236/ojog.2014.47064>

low and middle-income countries. Statistics from four-year American training programs showed an average of 209 minor cervical procedures performed annually. Conclusion: Expertise in minor gynecologic procedures is vital and requires the development of both adequate training programs and local medical infrastructure. Strategies for training in minor surgery for providers in low and middle-income countries include online curriculums, mentored relationships with senior physicians, and simulation models.

Keywords

Minor Surgery, Gynecology, Dilation and Curettage, Hysteroscopy, Cone Biopsy, Residency Training, LMICs

1. Introduction

Minor surgeries in gynecology encompass a broad range of procedures with goals to range from diagnosis to treatment. In the United States, minor surgeries are among the most common gynecologic procedures, whereas in low and middle-income countries (LMICs), minor procedures are less commonly performed. The reasons for this discrepancy are complex and include a lack of access to care, finances, and adequately trained providers. One report estimated that one third to one half of the population of the world lacked access to basic surgical care [1]. A survey performed by Uganda's Ministry of Health showed that 44% of surgeries performed annually were Obstetrics and Gynecology (Ob Gyn) cases and 73% of these were performed on an emergency basis [2]. Physicians may not see patients with early premalignant and malignant lesions where minor surgery is the mainstay of diagnosis and treatment. Cultural beliefs in some LMICs can delay management of potentially curable cancers by preventing women from seeking early medical attention [3].

The consequence of rarely performing minor surgical procedures leads to marginal surgical training experiences for specialists in women's care in LMICs. As medical infrastructure and access to medical care are built in LMICs, a rigorous training program to develop appropriate surgical skills in minor gynecologic procedures for trainees and junior faculty needs to be instituted. We review current literature on minor gynecologic surgery in LMICs and discuss available and effective training models.

2. Method

A PubMed search of English language papers from 1970 to the present time was performed using MESH terms cone biopsy, dilation and curettage, hysteroscopy, and LEEP linked to training and education. In addition, MESH terms gynecologic surgery, training, and developing and LMIC countries were searched. Statistics of minor surgical procedures among US Obstetrics and Gynecology Residency programs were tabulated through access to the publically available ACGME annual report [4]. We then searched for data of training programs and surgical statistics in low resource countries through both PubMed and also Google internet searches. Coauthors, (JN, FI, MF), who work at teaching institutions in Uganda (Mbarara University Teaching Hospital) and Bangladesh (Dhaka Medical College Hospital and Birdem Hospital) respectively contributed information about training curriculums in these countries.

3. Results

3.1. Review of Minor Surgery Training in the United States, Bangladesh, and Uganda

There are currently 242 residency programs in Obstetrics and Gynecology in the United States with a yearly average of 1221 graduating residents. There is a significant range of surgical experience for minor surgeries. **Table 1** lists the minor procedures expected to be mastered in United States Obstetrics and Gynecology Residency programs as defined by the Council on Resident Education in Obstetrics and Gynecology [5]. There are twelve procedures ranging from the visual examination by colposcopy to laparoscopy. The 2012 national statistics for minor surgeries which are publically available on the ACGME website are summarized in **Table 2** [4]. At four of the authors' current or previous institution (RMC, LSB, JO-A, AG), the combined Massachusetts General

Table 1. The United States residency standard expectations of surgical mastery.

Minor Procedures	Type
	ablative procedures on the cervix
	biopsies of cervix, endocervix, peritoneum, skin, vagina, vulva
	cervical conization
	colposcopy
	dilation and curettage and suction curettage
	hysteroscopy diagnostic and operative
	laparoscopy diagnostic and operative
	polypectomy
	ultrasonography-abdominal and endovaginal
	vulvar wide local excision
	trachelectomy
	vulvectomy, simple

Reference: [42].

Table 2. Acgme mean statistics (with range) for 2012 graduating residents in US obstetrics and gynecology programs (Surgeon Only).

Procedure	Number performed	Range
Operative Laparoscopy	98.3	(18 - 365)
Hysteroscopy	76	(10 - 317)
Cervical Conization	17	
Surgical Sterilization	84	
Cervical Cerclage	33	
Transvaginal Ultrasound	120	(0 - 623)
Invasive Cancer Cases	65.9	(0 - 329)
Abortion	46	(4 - 301)

Reference: [4].

Hospital and Brigham and Women’s Hospital (MGH-BWH) residency program, graduating residents, who complete four years of postgraduate training, have performed on average 209 minor surgical procedures which include D&Cs, abortions, hysteroscopy, LEEP, cone biopsies, and simple vulvar excisions. MGH-BWH Ob Gyn residents graduate with an average of 80 diagnostic laparoscopic cases [4].

In contrast, there are no specific statistics for graduating residents for programs in developing countries. The general education and training for physicians interested in Obstetrics and Gynecology in Bangladesh and Uganda are summarized here. In Bangladesh, a five-year degree program after completion of secondary school leads to the degree of MBBS (Bachelor of Medicine and Bachelor of Surgery) [6]. The degree includes a mandatory year of internship where the student rotates through Medicine, Surgery, and Ob Gyn. Following graduation, the majority of new graduates practice general medicine. A fraction of graduates then apply for a Master’s program to obtain further training in Obstetrics and Gynecology. Most Master’s degree programs have a largely theoretical base of didactics and thesis requirements, of which hands-on surgical training is a rare component. As a result, the majority of one’s surgical experience is gained after graduation, while in practice and without expert supervision.

In Uganda, a similar five-year program of medical education leads to a Bachelor of Medicine and Bachelor of Surgery degree (MBChB). The next year, the sixth year, is the year of internship (Junior House Officers) where as a mandate they rotate in the four major clinical disciplines of Internal Medicine, Pediatrics, Surgery and Ob Gyn. The majority of the graduates will practice general medicine after the MBChB degree [7]. Postgraduate “residency” education in Obstetrics and Gynecology involves three years of training leading to a Masters in

Medicine degree (MMed). Not many medical doctors will enroll for the Residency program because it is quite costly and all Residents coming in to study are privately sponsored. Thus without a scholarship, it becomes almost impossible to enroll for residency. On average, residents will have practiced in the field for three years prior to initiating their postgraduate training [8]. The Ob Gyn Residency program in Mbarara University is structured in three phases according to the years of study. Each of these three phases involves a certain minimal skills acquisition in terms of both major and minor surgeries. Each of the Resident students is attached to a mentor who works hand in hand with them and sees to it that their skills logbooks are duly signed and recommends that this particular student is competent in certain minimum skills. Surgical procedures are performed during this postgraduate training; however the majority is emergency cesarean sections and hysterectomies.

3.2. Literature Review of Training in Minor Surgery

Given the paucity of published data regarding training programs and assessment of trainees in LMICs, a literature review was performed. We identified twenty-eight papers that focused on minor gynecologic surgery and surgical outcomes. Nineteen of these papers included information on training of residents. An additional sixteen papers focused on training techniques and simulation models for gynecologic surgery including four on colposcopic training, two models for D&C, nine on hysteroscopy, and one model for teaching LEEP excision.

3.3. Minor Gynecologic Surgery

A review of the international literature on experience with minor gynecologic procedures and training in these procedures reveals an eclectic mix of articles summarized in [Table 3](#).

3.4. Dilation and Curettage

Cervical dilation and curettage (D&C) is the most frequent gynecologic procedure in the United States. Both in the United States and internationally, it is indicated for the evaluation of abnormal uterine bleeding; to control dysfunctional uterine bleeding, relieve pelvic pain and dysmenorrhea secondary to cervical stenosis, to evaluate causes of infertility, and to evacuate products of conception. It is a simple procedure that can be performed in an outpatient setting. However, despite its prevalence in the US there are only a few publications from developing countries. One report from Thailand evaluated the use of intrauterine anesthesia in 66 patients and determined that effective analgesia allowed outpatient procedures [9]. There are a few publications from LMICs regarding the frequency with which this procedure is performed, training, and complication rates. A review from Jordan identified the leading factor for uterine perforation as being due to operator inexperience. Of 22 cases of perforation among 11914 women, 22 occurred from a trainee [10]. An analysis from Tanzania reported bowel perforation as the most common complication in D&Cs for abortion in inexperienced hands [11]. D&C has been taught and used as menstrual regulation in Bangladesh [12]. Another study from El Salvador noted that one of the barriers to use of vacuum aspiration for incomplete abortion was physician training [13]. Because of difficulty obtaining access to trained providers, a multi-country study in sub-Saharan African countries evaluated the use of the medicine misoprostol as an alternative to D&C [14].

3.5. Hysteroscopy

Hysteroscopy, another common minor gynecologic procedure, is an effective diagnostic and therapeutic surgical

Table 3. Summary of international literature on teaching minor surgery.

Country	Surgical procedure	Number of articles
Kenya, USA	colposcopy	4
Bangladesh, Jordan	D&C	5
El Salvador, Nigeria, USA		
Australia, Canada, Holland	hysteroscopy	9
Singapore, Spain, Switzerland		
Austria, Kenya, Zambia	LEEP	3
Austria, Canada, USA	Cone biopsy	3

References: [32] [33] [36] [49]-[51] [54] [56] [58] [61] [64]-[66] [68]-[71] [75].

tool for many gynecologic disorders [15]. One study from India found that indications for hysteroscopy in a cohort with a median age range of 36 to 40 years included menorrhagia in 30 % of cases, menometrorrhagia in 16%, oligomenorrhea in 16%, and postmenopausal bleeding in 2 % of patients. Intrauterine pathology was identified in 74% of these patients [16]. Hysteroscopy increases the yield on intracavitary intrauterine lesions whereas blind D&C alone can miss up to 70% of small focal lesions [17] [18]. This minor surgery requires more sophisticated equipment than D&C alone including a camera, a light source, and insufflating solutions. While this equipment has become routine in high resource countries, absence of supplies and the inability to repair equipment can be a limiting factor for treating those patients in LMICs [3] [19].

In Serbia, a prospective study of 2000 women demonstrated that the majority of cases (78%) were performed under intravenous anesthesia. Polypectomy and myomectomy were the most common intervention and cancers were identified in 0.2% of cases [20]. In Kenya, hysteroscopic surgery at a major regional hospital increased from 50 in year 2000 to 159 cases two years later. All surgeries were performed by senior faculty (consultants) and did not include doctors in training [21].

3.6. Procedures for Preinvasive and Invasive Cervical Neoplasia

Cervical cancer, the leading cause of cancer death in low-income countries, has driven the major focus of low cost, preventative gynecologic care [22]. The see-and-treat approach with cryotherapy is useful for small cervical lesions [23]. Larger lesions require minor surgical procedures such as LEEP (loop electrosurgical excision procedure), cone biopsy, and even trachelectomy for fertility preservation [24] [25]. However as the majority of women present with late stage cervical cancer, training in minor surgery is minimal in these countries [26]. One retrospective study analyzed cases of clinically diagnosed cervical cancer managed at a state teaching hospital in Nigeria over six years [27]. Almost forty percent of women with cervical cancer had stage three diseases and seventeen percent had stage four diseases. Thirty percent of patients were lost to follow-up prior to staging.

Doctors-in-training had no exposure to minor surgeries, fertility sparing treatments, and radical surgery for which there is a paucity of data in the developing world. In 2000, the experience of two regional hospitals in Zimbabwe was summarized. One hundred ninety-six women with cervical cancer, with a median age of 47 years (range 24 to 80 years) were identified. Eighty percent had advanced disease and were treated with radiation therapy. None of the women had ever been screened for cervical cancer [28]. Ten years later, the experience with ten women aged 35 to 60 years who underwent type III radical hysterectomy for stage Ib cervical cancers was reported [30]. Three patients had adjuvant teletherapy (one was stage IIb, diagnosed intra-operatively). There have been no recurrences. One case was complicated with rectovaginal fistula and another had bilateral lymphedema and left lower limb sensory neuropathy. The authors conclude that definitive surgery for early cervical cancer is feasible in developing countries despite limited resources [29]. An examination of inappropriate surgery such as hysterectomies and even D&Cs by untrained practitioners reported on a high rate of complications, recurrence, and death and reinforces the urgent need of surgical training programs in developing and un-developed countries [30].

Important consequences to young women who are not offered minor surgery is loss of their fertility particularly when they may have lesions that can be cured by cone biopsy [31] and greater risks of postoperative complications by undergoing major surgery. While colposcopic training has become the foundation for cervical cancer screening and evaluations in North American residency training programs [32] [33], the concept of low technology, single visit screening and treatment has been an active area of investigation internationally for the past twenty years [34].

In the mid-1990s, the use of LEEP versus laser for treatment of cervical preinvasive disease was prospectively examined in one study in Peru where women were randomized to one of these two treatment options. Factors predisposing to failure to adequately treat included depth of surgical defect, grade of lesion, and operator's expertise. In this study LEEP was faster, less costly, and required less expertise in developing countries [34]. Adequacy of margin status of cone biopsy and LEEP was evaluated by the level of training and sub-specialization [35]. Sub-specialists had a 5 percent positive margin status compared to a 16% and 22% positive margin status of residents and generalist respectively. This data supports the importance of appropriate and adequate training even for this minor procedure.

Complications can occur with minor surgery. Complication rates are directly associated with volume of surgery and level of training. In a review of 293 conizations performed by residents, major complications of cervical stenosis and heavy bleeding occurred in 20% of cold knife cones and 65% of laser excisions [36]. An analysis

of thirty-two original research articles on the safety of cryotherapy and LEEP excision in LMICs performed between January 1995 and April 2009 analyzed a combined sample of 6,902 women treated by cryotherapy and 4524 women treated by LEEP. Countries in Asia and Africa were the most common locations. Short-term complications from cryotherapy and LEEP appeared similar to rates in high-income countries [37].

4. Discussion

4.1. Significance of Minor Surgery

Minor surgery is a cornerstone of diagnosis and treatment in the field of gynecology. Women can present throughout their life cycle with symptoms of pelvic pain, visible and palpable growths, lesions, and ulcers in the female lower genital tract. Internationally, one third of visits to gynecologists are due to abnormal and irregular bleeding from the lower genital tract [16]. Practitioners who care for women are challenged to understand the etiology of particular signs and symptoms and to develop appropriate treatment plans.

The ability to evaluate and diagnose basic gynecologic conditions requires expertise in colposcopic evaluation, minor surgical procedures, and in diagnostics imaging [32] [38]. There is compelling evidence that complications rise when surgical procedures are performed by inexperienced and low volume surgeons [39].

4.2. Training

Residency Training programs in Obstetrics and Gynecology must include training in ultrasound, and minor surgical procedures [40]. In the United States, the requirements for minor surgical training are outlined in the educational objectives and competency requirements of residency programs [5] [41]. Despite the implementation of residency work hour restrictions, the overall surgical volume during training has been stable over the past five years. Interestingly, there has been a 16 percent increase in minor surgical procedures in some American residency programs [42]. Likewise, the majority of minor surgeries have been safely performed in the outpatient setting in the United States since the 1980s [43]. There are variations such as a reduction in cone biopsy experience that may mirror the increasing use of LEEP excision [44].

It is important to note that for many established programs, evaluation of the success of residency training has changed from a time-based metric to one determining the competency of trainees in multiple areas ranging from knowledge, analysis of data, development of treatment plans, to skills. The competency-based model of medical training with evidence-based evaluations is difficult to transfer to programs in low-income countries [45].

4.3. Challenges in LMICs

Programs in LMICs face many challenges to the training of their students and residents. These challenges range from lack of appropriate diagnostics tests, lack of equipment needed to performing biopsies and minor surgeries, to lack of funding. An evaluation of pediatric surgery training programs in eight African countries highlighted the problems of poverty, late presentation, shortage of manpower and poor facilities and support laboratories [46]. These issues can be generalized to all surgical specialties. For instance, in Ghana, despite a dire need, manual vacuum aspiration equipment is difficult to obtain due to challenges with implementing sustainable purchasing mechanisms for health provider associations [47].

In many countries, patients must pay for their pathology, diagnostic testing and treatment. Difficult decisions about whether to spend money on a test or on an empiric treatment can guide treatment planning. In a Sierra Leone household survey of surgery and mortality, patients and families did not seek medical care because of lack of funds in 35% of cases [48]. Other challenges include a difference hierarchical structure for the performance of surgery. Students and residents may not have the opportunity to participate as a primary surgeon in surgical procedures. Thus graduating doctors must look for personal mentorship to continue their surgical training.

An analysis of barriers to care in Bangladesh identified several key issues. These included distance to health facilities and transportation costs. Other concerns were unofficial fees, lack of privacy and confidentiality and concern about the cleanliness of facilities. Quality of care issues included inadequacies in infection control and inadequacies in provider training. Finally significant under-reporting of cases by doctors occurred who do not wish to make public their unofficial fees [12].

A final challenge is that patients often do not present to medical attention until they have a far advanced pa-

thologic condition. This is due to a variety of factors including patient education or lack thereof, access to care and distance to appropriate treatment centers. Even for patients presenting with early-stage cervical cancer that could be treated with an equally effective yet less radical procedure such as a cone biopsy poor follow-up rates contribute to uncertainty about outcomes. Thus a full hysterectomy is often performed.

4.4. Evaluation of Training Programs

Annual evaluation of training programs in high-income countries is coordinated by the national obstetrics and gynecologic organizations of the particular country [5] [41] [55]. Other evaluations of specific programs have been reported by conducting online evaluations. In Canada a survey to 775 Canadian residents, fellows, and practicing physicians examined the level of training required to perform endoscopic procedures. The opinion among practicing physician was that fellowship training was necessary for advanced endoscopic skill acquisition [49]. In Spain, another survey of hysteroscopic and laparoscopic skills in 198 departments revealed that in teaching hospitals, residents were able to perform appropriate endoscopic techniques upon graduation. Overall, they reported that 90% of graduates could perform basic endoscopic techniques and 83.4% could perform advanced endoscopic procedures [50].

It is clear that surgical teaching and training are most effectively accomplished during existing training programs rather than once a graduate is in practice. If young doctors graduate with marginal surgical training, they are discouraged from implementing these surgical procedures into their daily practice. Three important factors need to be addressed in surgical teaching. First, how are the skills of students and doctors in training evaluated? Second, how many specific surgical procedures are needed for the establishment of expertise? Finally, what teaching tools are available to increase surgical skills?

The Dutch society of Obstetrics and Gynecology (NVOG-HOOG) developed a global rating scale for competence (Table 4) [51]. For each level of competence, the surgeon’s skill set can be assessed by analyzing the various factors: respect for tissue, time and motion, instrument handling and knowledge, flow of procedure, use of assistants, and communication skills [52] [53]. Another group developed a scoring system for simulator training, which included four modules of skill evaluation: visualization, ergonomics, safety, and fluid handling [54].

The number of surgical cases alone cannot determine competency. Complexity must also be taken into consideration. Using operative time as an indicator of expertise, one group determined that 105 to 108 cases were needed for proficiency in complex laparoscopic surgery [56]. NVOG-HOOG suggests a much lower target number for minor surgical procedures. They recommend 40 hysteroscopic cases and 10 cases for resection of polyps [51]. The German Society of Obstetrics and Gynecology has not only made recommendations on the number of cases required for expertise by the trainee, they have developed requirements for institutional qualification based on the expertise of the faculty and the number of cases performed at the institution [56].

4.5. Models for Surgical Teaching

Solutions to training challenges have ranged from online programs, simulators, to hands on training. Table 5 summarizes the types of tools used for surgical training in LMICs. It is instructive to look at international training programs in all of the surgical specialties. An early example of an online program is FIGO’s Teaching Manual on Human Reproduction. The effectiveness of this resource was analyzed through the questionnaire responses of 100 heads of teaching departments, mostly of obstetrics and gynecology from 32 LMIC countries. The most significant finding was that educator access to this teaching material allowed increased teaching to a very

Table 4. The Dutch society of obstetrics and gynecology (NVOG-HOOG) global rating scale for surgical competence.

Scale	Definition
Level 1	has theoretical knowledge
Level 2	able to perform under strict supervision
Level 3	able to perform under limited supervision
Level 4	able to perform without supervision
Level 5	able to supervise and educate others

Reference: [52].

Table 5. Surgical training tools for developing countries.

Resource	Tool
Internet	Online tutorials E-Mentoring Computer Simulation
Conventional education	Direct didactics Development of onsite medical school program Development of onsite Diploma in Surgery program
Hands-on training	Simulation models Cadavers Hands on surgical curriculum Supervised performance
Mentors	Short term international surgical volunteers College without walls practitioners as mentors Residents as teachers

large number of medical and other students in these countries [57]. Another example is the American Society for Colposcopy and Cervical pathology (ASCCP)'s Home Study Course to develop colposcopic skills [58]. An e-mentoring program in radiology for residents in Nigeria discusses the formation of a community of learners who can then proceed to expand knowledge acquisition and mentoring on a local level [59]. Jhpiego, an international non-profit health organization which was started by Johns Hopkins University, has developed online training modules on the development of infrastructure in education in Obstetrics and Gynecology [60]. Computer simulation can be used to teach both basic procedural skills and cognitive knowledge [61]. Direct didactic education combined with slide sets of colposcopic lesions, training demonstrations, knowledge testing, and hands on training was accomplished to teach VIA and colposcopy to clinical medical officers in Kenya [62]. A multi-national program among postgraduate trainees in Obstetrics and Gynecology in seven LMICs (Argentina, Brazil, Democratic Republic of the Congo, India, Philippines, South Africa, and Thailand) evaluated eight-week e-modules in Obstetrics and Gynecology with assessments at baseline and 4 weeks after course completion. Higher knowledge and skill scores occurred with this electronic resource [63].

Due to concerns about reductions in numbers of surgical cases and training work hours, simulation models have been developed and incorporated into the educational curriculum of residency programs in North America and Europe. Simulation models have been used for various procedures. Hands on training using porcine tissues for LEEP procedures have been an effective and realistic teaching modality. One study demonstrated a significantly better LEEP performance for participants after using this model and recommended that hands-on LEEP training should be incorporated into gynecology residency programs [64]. Low cost trainers for LEEP practice can be easily constructed [65]. Simulator models have become an important tool in surgical training [66]. The training capacity of a virtual reality trainer for hysteroscopy was endorsed by experienced surgeons and recommended as a training tool for surgeons-in-training [54]. One randomized trial showed a significant improvement in performance of residents after warm-up on a simulator [67]. Models have been developed to teach D&C techniques [68]. A papaya can be used for training in uterine aspiration. Ninety-two percent of trainees using this model reported high training benefit [69]. In Holland, simulator training has been incorporated into the residency curriculum in a staged and stepwise escalation of complexity and stresses the importance of developing hand eye coordination [51]. The authors identified the need to schedule time into the residency program for repetitive training.

Simulators can vary from basic home-made boxes that allow practice of hand-eye coordination to sophisticated video equipment. For hysteroscopy, models ranging from a red pepper to a porcine bladder allow students

to practice basic skills such as placement of the equipment within the uterus to removal of polyps [51] [70]. Another study evaluated the use of both a written multiple-choice questionnaire and a pelvic-trainer and found the written testing improved and focused skill-set training [71]. The use of cadavers as a tool for surgical training identified this teaching modality as another effective option [72].

A surgical curriculum was developed by the Gynaecologic Oncologists of Canada that included a pretest and a posttest. Canadian gynecologic oncologists mentored local doctors and doctors-in-training in Kenya. Seven graduated sections of the curriculum included preoperative evaluation of the patient, cone biopsy, radical hysterectomy, pelvic lymphadenectomy, ureteric injury, vascular injury, and follow-up after surgery [73].

Short-term visits by international surgical volunteers to teach surgical skills are another mechanism for onsite training of students and doctors in training in LMICs. One group noted that the number of surgeries accomplished was three times higher and more complex during international surgical teaching in a Gambian teaching hospital. They concluded that short term visits allowed an opportunity to train both students and local staff [74]. In a see-and-treat cervical cancer screening program for HIV positive women in Zambia, physicians were trained to perform LEEP excisions through a four step program: didactic sessions, simulator models, observation, and supervised performance [75]. Complications rates for LEEP excisions by clinical officers in Kenya were evaluated as part of an assessment of training needs [76]. Fifty-two percent of women had mild symptoms of bleeding, discharge, and pain one week after the procedure. There were no severe complications.

Another program in Tanzania developed new student rotations in obstetrics and surgery at a busy rural teaching hospital which led to increased training of students in operative obstetrics by supervised hands on surgical cases [77]. In East, Central, and Southern African regions, candidates can obtain advanced general surgical training after being in general practice for an average of three years after medical school [9]. The College of Surgeons of East Central and Southern Africa (COSECSA) has developed a “college without walls” to train medical officers using all available resources such as regional, missionary and district hospital. There is consideration of increasing mentoring through electronic outreach to improve surgical skills [9]. The Central America Gynecologic Oncology Education Program (CONEP) provides educational programs utilizing biannual didactic lectures and surgical training by visiting gynecologic oncologists in six Central American countries [78]. In Guyana, the ministry of health developed an onsite Diploma in Surgery program in surgery and requested the help of visiting faculty from Canada [79]. This program developed a twenty-four module, two-year course of study using both visiting staff and local faculty, which has increased the standardization of surgical care in Guyana. The Pan-African Academy of Christian surgeons (PAACS) has developed a five-year American competency based model of surgical training and has established six training programs in four countries [80].

While residents-as-teachers are common in programs in high resource countries, this is a rare modality of teaching in Asian and developing countries. Programs both in India and Iran have harnessed the education of senior medical residents with also utilizing senior residents as teachers of medical students and junior residents [81] [82]. The programs involve teaching-method workshops for the residents.

5. Conclusion

Care of women requires competent and safe obstetrics, management of infertility, evaluation, diagnosis and treatment of benign gynecologic conditions, cancer screening, and cancer care. Intensive worldwide efforts at low cost cervical cancer screening are now well established. Many innovative and creative modalities for education and training are available and most are transferable to low resource environments. These resources, however, are underutilized due to lack of funding and well-trained personnel. Cervical cancer screening serves as an ideal model for initiating effective training programs in minor surgery, and also provides an opportunity to have an incredible impact on reducing mortality worldwide. As early-stage cervical cancers are identified through these low-cost and low-tech screening programs, it has become crucial to train local providers in minor surgery as well as to create centers for more sophisticated cancer care. As these training programs take root, the great disparities in fertility preservation and cancer care for women between developed countries and LMICs will diminish.

References

- [1] Contini, S. (2007) Surgery in Developing Countries: Why and How to Meet Surgical Needs Worldwide. *Acta Bio Medica Atenei Parmensis*, **78**, 4-5.

- [2] Linden, A.F., Sekidde, F.S., Galukande, M., Knowlton, L.M., Chackungal, S. and McQueen, K.A. (2012) Challenges of Surgery in Developing Countries: A Survey of Surgical and Anesthesia Capacity in Uganda's Public Hospitals. *World Journal of Surgery*, **36**, 1056-1065. <http://dx.doi.org/10.1007/s00268-012-1482-7>
- [3] Haththotuwa, R., Goonewardene, M., Desai, S., Senanayake, L., Tank, J. and Fraser, I.S. (2011) Management of Abnormal Uterine Bleeding in Low- and High-Resource Settings: Consideration of Cultural issues. *Seminars in Reproductive Medicine*, **29**, 446-458. <http://dx.doi.org/10.1055/s-0031-1287668>
- [4] Accreditation Council for Medical Education (2012) Obstetrics and Gynecology Case Logs National Data Report. Accessed September 1, 2013. <http://www.acgme.org/acgmeweb/Portals/0/ObGynNatData1112.pdf>
- [5] CREOG (2013) Educational Objectives: Core Curriculum in Obstetrics and Gynecology. 10th Edition, Accessed September 1, 2013. <http://www.acog.org/~media/Departments/Members%20Only/CREOG/CREOGEducationalObjectives.pdf?dmc=1>
- [6] Amin, Z., Merrylees, N., Hanip, A. and Talukder, H.K. (2008) Medical Education in Bangladesh. *Medical Teacher*, **30**, 243-247. <http://dx.doi.org/10.1080/01421590801947010>
- [7] Kigonya, E. (2004) Medical Education in Uganda—A Critique. *East and Central African Journal of Surgery*, **9**, 1-4. <https://tspace.library.utoronto.ca/bitstream/1807/6968/1/js04026.pdf>
- [8] Galukande, M., Ozgediz, D., Elobu, E. and Kaggwa, S. (2013) Pretraining Experience and Structure of Surgical Training at a Sub-Saharan African University. *World Journal of Surgery*, **37**, 1836-1840. <http://dx.doi.org/10.1007/s00268-013-2053-2>
- [9] Rattanachaiyanont, M., Leerasiri, P. and Indhavivadhana, S. (2005) Effectiveness of Intrauterine Anesthesia for Pain Relief during Fractional Curettage. *Obstetrics & Gynecology*, **106**, 533-539. <http://dx.doi.org/10.1097/01.AOG.0000172424.09992.3e>
- [10] Amarin, Z.O. and Badria, L.F. (2005) A Survey of Uterine Perforation Following Dilatation and Curettage or Evacuation of Retained Products of Conception. *Archives of Gynecology and Obstetrics*, **271**, 203-206. <http://dx.doi.org/10.1007/s00404-003-0592-8>
- [11] Mabula, J.B., Chalya, P.L., McHembe, M.D., Kihunrwa, A., massinde, A., Chandika, A.B. and Gilyoma, J.M. (2012) Bowel Perforation Secondary to Illegally Induced Abortion: A Tertiary Hospital Experience in Tanzania. *World Journal of Surgery*, **7**, 29. <http://dx.doi.org/10.1186/1749-7922-7-29>
- [12] Chowdhury, S.N. and Moni, D. (2004) A Situation Analysis of the Menstrual Regulation Programme in Bangladesh. *Reproductive Health Matters*, **12**, 95-104.
- [13] Koontz, S.L., Molina de Perez, O., Leon, K. and Foster-Rosalies, A. (2003) Treating Incomplete Abortion in El Salvador: Cost Savings with Manual Vacuum Aspiration. *Contraception*, **68**, 345-351. [http://dx.doi.org/10.1016/S0010-7824\(03\)00162-8](http://dx.doi.org/10.1016/S0010-7824(03)00162-8)
- [14] Shocet, T., Diop, A., Gaya, A., Nayama, M., Sall, A.B., Bukota, F., Blandine, T., Abiola, O.M., Dao, B., Olayinka, O. and Winikoff, B. (2012) Sublingual Misoprostol versus Standard Surgical Care for Treatment of Incomplete Abortion in Five Sub-Saharan African Countries. *BMC Pregnancy and Childbirth*, **12**, 127. <http://dx.doi.org/10.1186/1471-2393-12-127>
- [15] Soguktas, S., Cogendez, E., kayatas, S.E., Asoglu, M.R., Selcuk, S. and Ertekin, A. (2012) Comparison of Saline Infusion Sonohysterography and Hysteroscopy in Diagnosis of Premenopausal Women with Abnormal Uterine Bleeding. *European Journal of Obstetrics & Gynecology*, **161**, 66-70. <http://dx.doi.org/10.1016/j.ejogrb.2011.11.022>
- [16] Gita, G., Kaur, S.S., Arvind, L. and Shashi, K. (2011) Hysteroscopy in Evaluation of Abnormal Uterine Bleeding. *Journal of Obstetrics and Gynecology of India*, **61**, 546-549. <http://dx.doi.org/10.1007/s13224-011-0088-6>
- [17] Karsidag, K.A.Y., Buyukbayrak, E.E., Kars, B., Unal, O. and Turan, M.C. (2010) Transvaginal Sonography, Sonohysterography, and Hysteroscopy for Investigation of Focal Intrauterine Lesions in Women with Recurrent Postmenopausal Bleeding after Dilatation & Curettage. *Archives of Gynecology and Obstetrics*, **281**, 637-643. <http://dx.doi.org/10.1007/s00404-009-1150-9>
- [18] De Wit, A.C., Vieugels, M.P. and de Kruijff, J.H. (2003) Diagnostic Hysteroscopy: A Valuable Diagnostic Tool in the Diagnosis of Structural Intra-Cavitary Pathology and Endometrial Hyperplasia or Carcinoma? Six Years Experience with Non-Clinical Diagnostic Hysteroscopy. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, **110**, 79-82. [http://dx.doi.org/10.1016/S0301-2115\(03\)00165-9](http://dx.doi.org/10.1016/S0301-2115(03)00165-9)
- [19] Tsai, M.C. and Goldstein, S.R. (2012) Office Diagnosis and Management of Abnormal Uterine Bleeding. *Clinical Obstetrics & Gynecology*, **55**, 635-650. <http://dx.doi.org/10.1097/GRF.0b013e31825d3cec>
- [20] Kopitović, V., Budakov, D., Pjević, A.T., Pop-Trajković, S., Djurdjević, S., Ilić, D., Bjelica, A., Kapamadzija, A. and Milatović, S. (2012) Results and Experiences after 2000 Performed Hysteroscopies. *Srpski arhiv za celokupno lekarstvo*, **140**, 728-731. <http://dx.doi.org/10.2298/SARH1212728K>
- [21] Parkar, R.B. and Thagana, N.G. (2004) Hysteroscopic Surgery at the Aga Khan Hospital, Nairobi. *East African Medi-*

- cal Journal*, **81**, 336-340. <http://dx.doi.org/10.4314/eamj.v81i7.9187>
- [22] Chichareon, S.B. (2004) Management of Pre-Invasive Cervical Cancer in Low-Resource Setting. *Journal of the Medical Association of Thailand*, **87**, S214-S222.
- [23] Bradford, L.S. and Goodman, A. (2013) Cervical Cancer Screening and Prevention in Low Resource Settings. *Clinical Obstetrics & Gynecology*, **56**, 76-87. <http://dx.doi.org/10.1097/GRF.0b013e31828237ac>
- [24] Singla, S., Mathur, S., Kriplani, A., Agarwal, N., Garg, P. and Bhatla, N. (2012) Single Visit Approach for Management of Cervical Intraepithelial Neoplasia by Visual Inspection & Loop Electrosurgical Excision Procedure. *Indian Journal of Medical Research*, **135**, 614-620.
- [25] Bull-Phelps, S.L., Garner, E.I., Walsh, C.S., Gehrig, P.A., Miller, D.S. and Schorge, J.O. (2007) Fertility-Sparing Surgery in 101 Women with Adenocarcinoma *in Situ* of the Cervix. *Gynecologic Oncology*, **107**, 316-319. <http://dx.doi.org/10.1016/j.ygyno.2007.06.021>
- [26] Denny, L. (2011) Cervical Cancer Treatment in Africa. *Current Opinion in Oncology*, **23**, 467-474.
- [27] Eze, J.N., Emeka-Irem, E.N. and Edegbe, F.O. (2013) A Six-Year Study of the Clinical Presentation of Cervical Cancer and the Management Challenges Encountered at a State Teaching Hospital in Southeast Nigeria. *Clinical Medicine Insights: Oncology*, **7**, 151-158. <http://dx.doi.org/10.4137/CMO.S12017>
- [28] Chirenje, Z.M., Rusakaniko, S., Akino, V. and Mlingo, M. (2000) A Review of Cervical Cancer Patients Presenting in Harare and Parirenyatwa Hospitals in 1998. *Central African Journal of Medicine*, **46**, 264-267. <http://dx.doi.org/10.4314/cajmv.v46i10.8566>
- [29] Oladokun, A., Morhason-Bello, I.O., Bello, F.A. and Adewole, I.F. (2010) The Learning Curve of Radical Hysterectomy for Early Cervical Carcinoma. *African Journal of Medicine and Medical Sciences*, **39**, 329-332.
- [30] Kuyumcuoğlu, U. and Kale, A. (2008) Tragic Results of Suboptimal Gynecologic Cancer Operations. *European Journal of Gynaecological Oncology*, **29**, 620-627.
- [31] McHale, M.T., Le, T.D., Burger, R.A., Gu, M., Rutgers, J.L. and Monk, B.J. (2001) Fertility Sparing Treatment for *in Situ* and Early Invasive Adenocarcinoma of the Cervix. *Obstetrics & Gynecology*, **98**, 726-731. [http://dx.doi.org/10.1016/S0029-7844\(01\)01544-7](http://dx.doi.org/10.1016/S0029-7844(01)01544-7)
- [32] Homesley, H.D., Jobson, V.W. and Reish, R.L. (1984) Use of Colposcopically Directed, Four-Quadrant Cervical Biopsy by the Colposcopy Trainee. *Journal of Reproductive Medicine*, **29**, 311-316.
- [33] Kelley, J., Whitehouse III, H.H. and Dillard Jr., E.A. (1983) The Colposcopic Clinic in a Residency Training Program. Five Years' Experience with Colposcopically Directed Biopsies Followed by Conization or Hysterectomy. *Journal of Reproductive Medicine*, **28**, 127-130.
- [34] Santos, C., Galdos, R., Alvarez, M., Velarde, C., Barriga, O., Dyer, R., Estrada, H. and Almonte, M. (1996) One-Session Management of Cervical Intraepithelial Neoplasia: A Solution for Developing Countries. A Prospective, Randomized Trial of LEEP versus Laser Excisional Conization. *Gynecologic Oncology*, **61**, 11-15.
- [35] Ulrich, D., Tamussino, K., Petru, E., Haas, J. and Reich, O. (2012) Conization of the Uterine Cervix: Does the Level of Gynecologist's Training Predict Margin Status? *International Journal of Gynecological Pathology*, **31**, 382-386. <http://dx.doi.org/10.1097/PGP.0b013e318242118c>
- [36] Delmore, J., Horbelt, D.V. and Kallail, K.J. (1992) Cervical Conization: Cold Knife and Laser Excision in Residency Training. *Obstetrics and Gynecology*, **79**, 1016-1019.
- [37] Chamot, E., Kristensen, S., Stringer, J.S. and Mwanahamuntu, M.H. (2010) Are Treatments for Cervical Precancerous Lesions in Less-Developed Countries Safe Enough to Promote Scaling-Up of Cervical Screening Programs? A Systematic Review. *BMC Women's Health*, **10**, 11. <http://dx.doi.org/10.1186/1472-6874-10-11>
- [38] Bezircioglu, I., Baloglu, A., Cetinkaya, B., Yigit, S. and Oziz, E. (2012) The Diagnostic Value of the Doppler Ultrasonography in Distinguishing the Endometrial Malignancies in Women with Postmenopausal Bleeding. *Archives of Gynecology and Obstetrics*, **285**, 1369-1374. <http://dx.doi.org/10.1007/s00404-011-2159-4>
- [39] Wright, J.D., Lewin, S.N., Deutsch, I., Burke, W.M., Sun, X. and Herzog, T.J. (2011) The Influence of Surgical Volume on Morbidity and Mortality of Radical Hysterectomy for Cervical Cancer. *American Journal of Obstetrics & Gynecology*, **205**, 225.e1-225.e7. <http://dx.doi.org/10.1016/j.ajog.2011.04.014>
- [40] ACOG (2012) Technology Assessment in No 8: Sonohysterography. *Obstetrics & Gynecology*, **119**, 1325-1328. <http://dx.doi.org/10.1097/AOG.0b013e31825af435>
- [41] (ACGME-2) ACGME Program Requirements for Graduate Medical Education in Obstetrics and Gynecology. <http://www.acgme.org/acgmeweb/Portals/0/PFAssets/ProgramRequirements/220obstetricsandgynecology01012008.pdf>
- [42] Smith, R.P. (2010) Resident Technical Experience in Obstetrics and Gynecology before and after Implementation of Work-Hour Rules. *Obstetrics & Gynecology*, **115**, 1166-1171. <http://dx.doi.org/10.1097/AOG.0b013e3181de8cdb>

- [43] Hurt, W.G. (1991) Outpatient Gynecologic Procedures. *Surgical Clinics of North America*, **71**, 1099-1110.
- [44] Occhino, J.A., Hannigan, T.L., Baggish, M.S. and Gebhart, J.B. (2011) Resident Duty-Hour Restrictions and Their Effect on Operative Experience in Obstetrics and Gynecology. *Gynecologic and Obstetric Investigation*, **72**, 73-78. <http://dx.doi.org/10.1159/000323696>
- [45] Falconer, A.D. (2011) A Model for the Transfer of New Education Methodologies to Improve Capacity Development for Low-Income Countries. *International Journal of Gynecology & Obstetrics*, **112**, 167-168. <http://dx.doi.org/10.1016/j.ijgo.2010.12.005>
- [46] Chirdan, L.B., Ameh, E.A., Abantanga, F.A., Sidler, D. and Elhalaby, E.A. (2010) Challenges of Training and Delivery of Pediatric Surgical Services in Africa. *Journal of Pediatric Surgery*, **45**, 610-618. <http://dx.doi.org/10.1016/j.jpedsurg.2009.11.007>
- [47] Graff, M. and Amoyaw, D.A. (2009) Barriers to Sustainable MVA Supply in Ghana: Challenges for the Low-Volume, Low-Income Providers. *African Journal of Reproductive Health*, **13**, 73-80.
- [48] Kwon, S., Groen, R.S., Kamara, T.B., Cassidy, L.D., Samal, M., Yambasu, S.E. and Kushner, A.L. (2013) Nationally Representative Household Survey of Surgery and Mortality in Sierra Leone. *World Journal of Surgery*, **37**, 1829-1835. <http://dx.doi.org/10.1007/s00268-013-2035-4>
- [49] Arenda, K., Posner, G.D. and Singh, S.S. (2013) Managing Expectations of Surgical Training: A National Perspective on Gynecologic Endoscopy Practice. *Journal of Obstetrics and Gynaecology Canada*, **35**, 640-646.
- [50] Pascual-Pedreno, A., Perez-Medina, T., Brouard Urkiaga, I., Fernandez-Parra, J. and Sobreviela-Laserrada, M. (2013) Practice of Endoscopic Gynecologic Surgery: A Survey of Spanish Gynecologists. *European Journal of Obstetrics & Gynecology and Reproductive Biology*, **169**, 64-68. <http://dx.doi.org/10.1016/j.ejogrb.2013.01.017>
- [51] Hiemstra, E., Kolkman, W. and Jansen, F.W. (2008) Skills Training in Minimally Invasive Surgery in Dutch Obstetrics and Gynecology. *Gynecological Surgery*, **5**, 321-325. <http://dx.doi.org/10.1007/s10397-008-0402-1>
- [52] Doyle, J.D., Webber, E.M. and Sidhu, R.S. (2007) A Universal Global Rating Scale for the Evaluation of Technical Skills in the Operating Room. *American Journal of Surgery*, **193**, 551-555. <http://dx.doi.org/10.1016/j.amjsurg.2007.02.003>
- [53] Gofton, W.T., Dudek, N.L., Wood, T.J., Balaa, F. and Hamstra, S.J. (2012) The Ottawa Surgical Competency Operating Room Evaluation (O-SCORE): A Tool to Assess Surgical Competence. *Academic Medicine*, **87**, 1401-1407. <http://dx.doi.org/10.1097/ACM.0b013e3182677805>
- [54] Bajka, M., Tuchschnid, S., Fink, D., Szekely, G. and Harders, M. (2010) Establishing Construct Validity of a Virtual-Reality Training Simulator for Hysteroscopy via a Multimetric Scoring System. *Surgical Endoscopy*, **24**, 79-88. <http://dx.doi.org/10.1007/s00464-009-0582-4>
- [55] Pendlimari, R., Holubar, S.D., Dozois, E.J., Larson, D.W., Pemberton, J.H. and Cima, R.R. (2012) Technical Proficiency in Hand-Assisted Laparoscopic Colon and Rectal Surgery: Determining How Many Cases Are Required to Achieve Mastery. *Archives of Surgery*, **147**, 317-322.
- [56] De Wilde, R.L., Hucke, J., Kolmorgen, K. and Tinneberg, H. (2011) Recommendations by the Gynecologic Endoscopy Working Group of the German society of Obstetrics and Gynecology for the Advancement of Training and Education in Minimal-Access Surgery. *Archives of Gynecology and Obstetrics*, **283**, 509-512. <http://dx.doi.org/10.1007/s00404-010-1818-1>
- [57] Taylor Jr., H.C. and Magarick, R.H. (1981) An International System for the Education of Students of Medicine and Other Health Professionals in Human Reproduction. The FIGO Teaching Manual: A Status Report. *International Journal of Gynecology & Obstetrics*, **19**, 3-12. [http://dx.doi.org/10.1016/0020-7292\(81\)90032-1](http://dx.doi.org/10.1016/0020-7292(81)90032-1)
- [58] Spitzer, M., Dunton, C.J. and Jeronimo, J. (2006) Home Study Course: Spring 2006. *Journal of Lower Genital Tract Disease*, **10**, 123-125. <http://dx.doi.org/10.1097/00128360-200604000-00010>
- [59] Obura, T., Brant, W.E., Miller, F. and Parboosingh, I.J. (2011) Participating in a Community of Learners Enhances Resident Perceptions of Learning in an E-Mentoring Program: Proof of Concept. *BMC Medical Education*, **11**, 3. <http://dx.doi.org/10.1186/1472-6920-11-3>
- [60] Jhpiego <http://www.jhpiego.org/en/trainingmaterials>
- [61] Lefebvre, Y., Cote, J. and Lefebvre, L. (1996) Teaching Surgical Hysteroscopy with a Computer. *Journal of the American Association of Gynecologic Laparoscopists*, **3**, S25. [http://dx.doi.org/10.1016/S1074-3804\(96\)80218-0](http://dx.doi.org/10.1016/S1074-3804(96)80218-0)
- [62] Huchko, M.J., Bukus, E.A. and Cohen, C.R. (2011) Building Capacity for Cervical Cancer Screening in Outpatient HIV Clinics in the Myanza Province of Western Kenya. *International Journal of Gynecology & Obstetrics*, **114**, 106-110. <http://dx.doi.org/10.1016/j.ijgo.2011.02.009>
- [63] Kulier, R., Gülmezoglu, A.M., Zamora, J., Plana, M.N., Carroli, G., Cecatti, J.G., Germar, M.J., Pisake, L., Mittal, S., Pattinson, R., Wolomby-Molondo, J.J., Bergh, A.M., May, W., Souza, J.P., Koppenhoefer, S. and Khan, K.S. (2012)

- Effectiveness of a Clinically Integrated E-Learning Course in Evidence-Based Medicine for Reproductive Health Training: A Randomized Trial. *JAMA*, **308**, 2218-2225. <http://dx.doi.org/10.1001/jama.2012.33640>
- [64] Hefler, L., Grimm, C., Kueronya, V., Tempfer, C., Reinthaller, A. and Polteraer, S. (2012) A Novel Training Model for the Loop Electrosurgical Excision Procedure: An Innovative Replica Helped Workshop Participants Improve Their LEEP. *American Journal of Obstetrics and Gynecology*, **206**, 535.e1-535.e4.
- [65] Vella, P.V. (2002) A Simple Trainer for the Loop Electrosurgical Excision Procedure. *Australian and New Zealand Journal of Obstetrics and Gynaecology*, **42**, 289-291. <http://dx.doi.org/10.1111/j.0004-8666.2002.00289.x>
- [66] Burchard, E.R., Lockrow, E.G., Zahn, C.M., Dunlow, S.G. and Satin, A.J. (2007) Simulation Training Improves Resident Performance in Operative Hysteroscopic Resection Techniques. *American Journal of Obstetrics and Gynecology*, **197**, 542.e1-542.e4.
- [67] Chen, C.C., Green, I.C., Colbert-Getz, J.M., Steele, K., Chou, B., Lawson, S.M., Andersen, D.K. and Satin, A.J. (2013) Warm-Up on a Simulator Improves Residents' Performance in Laparoscopic Surgery: A Randomized Trial. *International Urogynecology Journal*, **24**, 1615-1622.
- [68] Gromko, L.J. and Eggertsen, S.C. (1988) Model for Teaching Cervical Dilatation and Uterine Curettage. *Journal of Family Practice*, **26**, 443-445.
- [69] Paul, M. and Nobel, K. (2005) Papaya: A Simulation Model for Training in Uterine Aspiration. *Family Medicine*, **37**, 242-244.
- [70] Ng, Y.W. and Fong, Y.F. (2013) Get "Real" with Hysteroscopy Using a Pig Bladder: A "Uterine" Model for Hysteroscopy Training. *Annals of the Academy of Medicine, Singapore*, **42**, 18-23.
- [71] Koch, J., Clements, S. and Abbott, J. (2011) Basic Surgical Skills Training: Does It Work? *Australian and New Zealand Journal of Obstetrics and Gynaecology*, **51**, 57-60. <http://dx.doi.org/10.1111/j.1479-828X.2010.01285.x>
- [72] Gilbody, J., Prasthofer, A.W., Ho, K. and Costa, M.L. (2011) The Use and Effectiveness of Cadaveric Workshops in Higher Surgical Training: A Systematic Review. *Annals of the Royal College of Surgeons of England*, **93**, 347-352. <http://dx.doi.org/10.1308/147870811X582954>
- [73] Elit, L.M., Rosen, B., Jimenez, W., Giede, C., Cybulska, P., Sinasac, S., Dodge, J., Ayush, E., Omenge, O., Bernardini, M., Finlayson, S., McAlpine, J., Miller, D. and International Community of Practice Committee of the Society of Gynecologic Oncology of Canada (2010) Teaching Cervical Cancer Surgery in Low- or Middle-Resource Countries. *International Journal of Gynecological Cancer*, **20**, 1604-1608.
- [74] Jah, A., Fowlis, G., Jah, S. and Just, J. (2013) The Role of International Short-Term Volunteers in Surgical Case Initiatives: The Gambian Experience. *Canadian Journal of Surgery*, **56**, S45.
- [75] Pfaendler, K.S., Mwanahamuntu, M.H., Sahasrabudhe, V.V., Mudenda, V., Stringer, J.S.A. and Parham, G.P. (2008) Management of Cryotherapy-Ineligible Women in a "Screen-and-Treat" Cervical Cancer Prevention Program Targeting HIV-Infected Women in Zambia: Lessons from the Field. *Gynecologic Oncology*, **110**, 402-407. <http://dx.doi.org/10.1016/j.ygyno.2008.04.031>
- [76] Woo, V.G., Cohen, C.R., Bukusi, E.A. and Huchko, M.J. (2011) Loop Electrosurgical Excision Procedure: Safety and Tolerability among Human Immunodeficiency Virus-Positive Kenyan Women. *Obstetrics & Gynecology*, **118**, 554-559. <http://dx.doi.org/10.1097/AOG.0b013e31822b0991>
- [77] Stafford, R.E., Mguta, C., Mtani, C., Morrison, C., Voeten, M.J., Chandika, A., Ervin, V. and Justus, S. (2013) "Treat and Train": A Novel Program Delivering Specialist Care to Rural Patients in Tanzania While Increasing Surgical Training Capacity. *Canadian Journal of Surgery*, **56**, S50.
- [78] Schmeler, K.M., Ramirez, P.T., Reyes-Martinez, C.A., Chernofsky, M.R., del Carmen, M.G., Diaz-Montes, T.P., Paddilla, L., Tarraza, H., Bermudez, A. and Trimble, E. (2013) The Central America Gynecologic Oncology Education Program (CONEP): Improving Gynecologic Oncology Education and Training on a Global Scale. *Gynecologic Oncology*, **129**, 445-447. <http://dx.doi.org/10.1016/j.ygyno.2013.03.013>
- [79] Cameron, B.H., Rambaran, M., Sharma, D.P. and Taylor, R.H. (2010) International Surgery: The Development of Postgraduate Surgical Training in Guyana. *Canadian Journal of Surgery*, **53**, 11-16.
- [80] Pollock, J.D., Love, T.P., Steffes, B.C., Thompson, D.C., Mellinger, J. and Haisch, C. (2011) Is It Possible to Train Surgeons for Rural Africa? A Report of a Successful International Program. *World Journal of Surgery*, **35**, 493-499. <http://dx.doi.org/10.1007/s00268-010-0936-z>
- [81] Singh, S. (2010) Senior Resident Training on Education Principles (STEP): A Proposed Innovative Step from a Developing Nation. *Journal of Educational Evaluation for Health Professions*, **7**, 3. <http://dx.doi.org/10.3352/jeehp.2010.7.3>
- [82] Haghani, F., Eghbali, B. and Memarzadeh, M. (2012) Effects of "Teaching Method Workshop" on General Surgery Residents' Teaching Skills. *Journal of Education and Health Promotion*, **1**, 38. <http://dx.doi.org/10.4103/2277-9531.104808>