Is it Possible to Train Surgeons for Rural Africa? A Report of a Successful International Program

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Abstract

Background  The critical shortage of surgeons and access to surgical care in Africa is increasingly being recognized as a global health crisis. Across Africa, there is only one surgeon for every 250,000 people and only one for every 2.5 million of those living in rural areas. Surgical diseases are responsible for approximately 11.2% of the total global burden of disease. Even as the importance of treating surgical disease is being recognized, surgeons in sub-Saharan Africa are leaving rural areas and their countries altogether to practice in more desirable locations.

Methods  The Pan-African Academy of Christian Surgeons (PAACS) was formed in 1997 as a strategic response to this profound need for surgical manpower. It is training surgical residents through a 5-year American competency-based model. Trainees are required to be of African origin and a graduate of a recognized medical school.

Results  To date, PAACS has established six training programs in four countries. During the 2009–2010 academic year, there were 35 residents in training. A total of 18 general surgeons and one pediatric surgeon have been trained. Two more general surgeons are scheduled to finish training in 2011. Four graduates have gone on to subspecialty training, and the remaining graduates are practicing general surgery in rural and underserved urban centers in Angola, Guinea-Conakry, Ghana, Cameroon, Republic of Congo, Kenya, Ethiopia, and Madagascar.

Conclusions  The PAACS has provided rigorous training for 18 African general surgeons, one of whom has also completed pediatric surgery training. To our knowledge, this is the only international rural-based surgical training program in Africa.

Introduction

The critical shortage of surgeons in rural parts of Africa is increasingly recognized as a global public health crisis. Many efforts and strategies have emerged to address this issue and to build up the surgical workforce in low- and middle-income countries [1]. The origins of the crisis run deep. With independence and the end of colonial rule in the middle of the 20th century, many physicians and surgeons left Africa and returned to Europe, leaving a massive shortage of health care workers. For example, in Mozambique only 80 physicians remained at the time of independence for a nation of 14 million people [2]. In addition, local ministries of health and the World Health Organization (WHO) began to focus available resources on primary care. At the 1978 World Health Conference in Alma Ata, USSR, WHO embarked on a 30-year experiment in primary health care. The primary health care push sought to...
extend basic health services to all people as a fundamental human right. Investment was made in low-cost, community-based interventions focusing on a smaller number of diseases using non-professional health workers [3]. While the aims were laudable, the unintended consequences were devastating to the surgical infrastructure and workforce in many countries, hitting rural areas particularly hard. In many parts of sub-Saharan Africa, there is one surgeon for every 250,000 people. In some rural areas there is only one surgeon for every 2.5 million people [4]. In addition to neglect of surgical services in rural areas, there has been an enticement of the surgical workforce away from these areas. Because of the lack of investment and commitment to surgeons and surgical infrastructure in rural areas, surgeons have concentrated in the major cities at university centers or in private practice where salaries are sufficient to support families, education is available for children, call schedules are sustainable, and basic equipment is available [5]. The need remains greatest in rural areas. Africa’s population has surpassed one billion and a significant majority, 60–65%, lives in rural areas [6]. Western countries are guilty of actively recruiting physicians from low- and middle-income countries to fill the gap in their own workforces. It is estimated that 25% of the physician workforce in the United States are from low-income countries and 60% of those are from low-income countries. The problem is even worse in the UK, with nearly 30% of the physician workforce from outside the UK and 75% of those being from low-income countries [7].

Efforts to increase surgical capacity in rural Africa are varied. Mission hospitals run by faith-based organizations (FBO) and short-term humanitarian missions often provide high-quality surgical services. Recently there has been interest in and preliminary experience with training non-physician surgical providers, or task shifting. While these efforts will likely be an essential component to improving surgical care in rural Africa in the short term, we believe that fully trained general surgeons are the cornerstone to reducing the surgical burden of disease in rural Africa and that it is possible to train and keep general surgeons in rural areas.

Materials and methods

The Pan-African Academy of Christian Surgeons (PAACS) is a strategic response to the profound need for surgical manpower in rural Africa. Initially conceived as a way to replace the dwindling ranks of expatriate missionary surgeons at faith-based mission hospitals, PAACS has expanded its vision to provide surgical training for African surgeons and place them in rural centers throughout the continent. The PAACS is a commission under the Christian Medical and Dental Association, which provides legal structure and administrative support but does not contribute to the operating budget. Candidates for training must be African graduates of recognized medical schools, preferably be less than 38 years of age, have a valid medical license in both their home and training countries, and speak English proficiently. Applicants submit a written application and are interviewed over the telephone. Personal interviews would be preferable, but the expense of travel prohibits in-person interviews. Academic accreditation is through Loma Linda University located in Loma Linda, California, which periodically provides site visits and evaluations to confirm the academic rigor of the programs. The accreditation process is ongoing with the College of Surgeons of East, Central, and Southern Africa (COSECSA), and application has been made to the West African College of Surgeons (WACS). Two general surgery programs have full 5-year, fellowship level accreditation from COSECSA, and a pediatric surgery fellowship is accredited for two of three years. All other programs have 2-year, membership level accreditation and are seeking further levels of accreditation. These programs are actively working to improve hospital facilities and develop required ancillary services to secure 5-year, fellowship level accreditation.

The PAACS currently consists of five general surgery programs and one pediatric surgery fellowship in four African countries. Training sites are detailed in Table 1. Current training programs have between three and eight residents, with some having a maximum capacity of 12 residents. Training sites average between 1,400 and 7,500 cases annually. Additional training sites have been established in Nigeria, Ethiopia, and South Africa for specialty rotations. The 5-year curriculum is based on the American competency-based model. Study of the basic sciences is integrated into the expected reading, rounds, patient care, and operating room teaching and is reinforced by weekly didactic conferences and required reports, presentations, and formal papers. Upon completion of the program, residents are bonded for one year of service for each year of training and are placed in carefully selected rural hospitals. Each training site has a program director, an expatriate general surgeon, who is board certified by the American Board of Surgery or the Royal College of Physicians and Surgeons of Canada, and the majority of programs have a similarly qualified assistant program director as well. In addition, four of six sites have African surgical faculty. Most of the full-time faculty have fellowships with the respective African surgical colleges (WACS or COSECSA) or are under consideration for fellowships. Full-time faculty are supported by their respective mission organizations or paid by the mission hospitals; they do not receive any funds directly from PAACS. Additional
teaching comes from the more than 180 subspecialists from North America, Europe, Asia, and Australia who have served for intervals ranging from 2 weeks to 2 years as part of the multinational PAACS network. In the 2009–2010 academic year alone, 119 volunteer faculty members served at their own expense.

Hospitals participating in PAACS training are required to adhere to a doctrinal statement and agree with the objectives of PAACS. In addition to general surgery faculty with an interest and ability in teaching, hospitals must have two modern operating rooms, at least 30 inpatient surgical beds, skilled anesthesia providers with capability for general anesthesia, and a case volume of at least 600 major operations per year. Hospital policy must not exclude charity care to the poor. The hospitals agree to provide healthcare coverage for the trainees and their families, a medical library, work visas, and housing for the duration of their training. Living stipends for the trainees are provided by PAACS. The entire operating cash budget for 2009–2010 was $460,000, and ongoing support is drawn from private donors, churches, and foundations.

In addition to the six existing training programs, nine additional hospitals have expressed interest in training residents as part of PAACS. One program in Cameroon closed after the program director returned to the United States. One other program in Cameroon was recently closed after a probation period demonstrated the inability of the hospital to meet the terms of the agreement, making it impossible to provide adequate training.

### Results

The PAACS was begun in 1997 with one resident and one training program. In recent years, PAACS has expanded to six training programs in four countries. Trainees have originated from 14 different countries: Angola, Burundi, Cameroon, Democratic Republic of Congo, Ethiopia, Gabon, Guinea, Kenya, Liberia, Madagascar, Mali, Nigeria, Sierra Leone, and Tanzania (Fig. 1). For the 2010–2011 academic year, there are 35 residents and fellows in training, and as of July 2010, 18 surgeons had completed training, with an overall experience of 1,512 major cases. One of these graduates has also graduated from the PAACS-sponsored pediatric surgery fellowship. Two other graduates have gone on to pediatric surgery subspecialty training, one resident has received additional training in orthopedics, and all but two of the others are practicing general surgery or pediatric surgery in rural centers in Angola, Guinea, Cameroon, Republic of Congo, Kenya, Ethiopia, and Madagascar (Fig. 2). The remaining two residents are serving underserved populations in urban areas. Two graduates are serving as PAACS faculty. Of 54 physicians accepted into the program, 10 residents have left training. Four have changed specialties and six were dismissed—two for disciplinary reasons, one for application fraud, and three for failure to progress academically.

Residents are evaluated on a weekly basis through written and oral quizzes associated with their weekly didactic conferences. An annual in-training examination is given to assess academic progress. The program directors and academic surgeons from North America prepare the

### Table 1  Training sites, trainees, and annual cases

<table>
<thead>
<tr>
<th>Hospital name</th>
<th>Location</th>
<th>Trainees</th>
<th>Annual cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bongolo Hospital</td>
<td>Lebamba, Gabon</td>
<td>6</td>
<td>1,400</td>
</tr>
<tr>
<td>Soddo Christian Hospital</td>
<td>Soddo, Wollaaita, Ethiopia</td>
<td>5</td>
<td>2,600</td>
</tr>
<tr>
<td>Mbingo Baptist Hospital</td>
<td>Bamenda, Cameroon</td>
<td>8</td>
<td>2,400</td>
</tr>
<tr>
<td>BethanyKids at Kijabe Hospital</td>
<td>Kijabe, Kenya</td>
<td>3</td>
<td>2,100</td>
</tr>
<tr>
<td>Tenwek Hospital</td>
<td>Bomet, Kenya</td>
<td>8</td>
<td>5,700</td>
</tr>
<tr>
<td>Kijabe Hospital</td>
<td>Kijabe, Kenya</td>
<td>4</td>
<td>7,500</td>
</tr>
</tbody>
</table>

![Fig. 1 Countries of origin of Pan-African Academy of Christian Surgeons (PAACS) trainees](image)
200-question exam annually. The exam has been formally evaluated and reliability indices have been determined to be 0.91–0.96. This level is consistent with the specifications of the American Board of Surgery In-Training Exam (ABSITE) and the American Board of Surgery Qualifying Exam. A reliability index of 0.8 or greater is expected for high level examination [8]. In addition, oral exams are given annually to assess knowledge and judgment and to prepare residents for formal accreditation exams by WACS or COSECSA. Residents expecting COSECSA accreditation are required to take and pass both the Members of College of Surgery (MCS) and Fellow of the College of Surgery (FCS) exams. To date, PAACS residents have performed at high levels, obtaining scores on accreditation exams that compare favorably to their peers from university programs. At present PAACS represents less than 10% of the surgical trainees under COSECSA authority. Only Kenyan and Ethiopian PAACS trainees have taken the MCS exam to date, and they have had a 100% pass rate on the written portion of the exam. One failed the oral exam the first time and is preparing to retake the exam. In 2009, a second year PAACS resident from Kijabe Hospital in Kijabe, Kenya received the highest score on the MCS exam.

Discussion

Healthcare in Africa is faced with many challenges. In addition to the well-known problems of human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS), malaria, and tuberculosis (TB), Africa has a critical shortage of surgeons, particularly in rural areas. Debas et al. [9] have estimated that 11.2% of the global burden of disease is due to surgical conditions, and sub-Saharan Africa has the highest percentage of surgical disability adjusted life years (DALYs). Multiple studies have shown the cost effectiveness of surgical care at the district hospital level [10–13].

For many years, FBOs have run mission hospitals, often in remote areas. These hospitals have made substantial contributions to health care delivery in many countries. For instance, up to 48% of healthcare delivery in Kenya is provided by religious nonprofit organizations and humanitarian nongovernmental organizations (NGOs) [14]. In fact, FBOs and NGOs are thought to contribute 40% of the health care services in sub-Saharan Africa [15]. However, in recent years, many such organizations have been closing hospitals, refocusing resources on community health initiatives and infectious diseases such as HIV, TB, and malaria [16].

Many recent efforts to increase surgical capacity in Africa have focused on “task shifting.” This is a term borrowed from HIV/AIDS work, and it involves the provision of surgical training to nonprofessional health workers or general medical practitioners. In Mozambique, common surgical problems such as herniorrhaphy, circumcisions, the incision and drainage of abscesses, amputations, and cesarean sections are performed by técnico de cirurgias, assistant medical officers with three years of training. Complication rates are reported to be acceptably low [17]. In the Democratic Republic of Congo, nurses were trained to provide emergency obstetric surgery [18]. Niger, Ethiopia, and Senegal have trained general practitioners to provide surgical care in rural areas [19–21].

While these task-shifting solutions will be a necessary component of increasing surgical capacity, we believe that the fully trained general surgeon is the cornerstone to improving surgical care in rural Africa. Surgery remains a very complex endeavor, requiring knowledge and understanding of difficult anatomy, physiology, pathophysiology, judgment in patient and operation selection, technical skill, mental and physical endurance, and commitment to patient care and well-being. The practice of general surgery is often more complex in rural Africa because of scarce resources, overwhelming need, and a paucity of subspecialists, forcing general surgeons to take on advanced gynecologic, urologic, orthopedic, head and neck, and even neurosurgical cases, in addition to general surgery and trauma. Patients often present with advanced disease. A surgical practitioner in rural Africa must be equipped with the maturity, experience, and judgment to face these challenges [5]. The PAACS has developed a curriculum suitable for this environment, balancing the realities of limited resources with the hope of tomorrow. It incorporates the requirements of the WACS and COSECSA.
The PAACS is, to our knowledge, the only international, rural based, surgical training program in Africa. It consists of a rigorous curriculum modeled after an American, competency-based training model similar to that used in community-based surgical training programs. To date, all but two graduates are practicing in rural hospitals or planning on practicing in rural areas after subspecialty training. The two graduates practicing in urban areas were among the first trained, before there was an internal requirement to serve 1 year in a rural area for every year of training. The 35 residents training in the 2010–2011 academic year have committed, as part of their training agreement, to practicing one year in a rural area for every year of training. All graduates who have completed their service obligation in a rural area have remained in surgical practice in an underserved area of Africa. The PAACS remains supportive of its graduates, assisting with placement in rural hospitals after graduation, providing continuing medical education, and assisting them with securing resources and supplies.

The 18 general surgeons and one pediatric surgeon trained by PAACS represent a small but important step toward reversing the surgical workforce deficiencies in sub-Saharan Africa. Official data are lacking, but it is not inconceivable that as many as 20 African nations have fewer than 20 surgeons. Recent reports have estimated that there are 14 surgeons in Sierra Leone for a population of 5.2 million and just 3 surgeons in Liberia for a population of 3.6 million [23, 24]. Additionally, there are only 10 pediatric surgeons certified in West Africa and 29 in East Africa and southern Africa [25].

Although the true cost to contributing parties is difficult to estimate, the 2009–2010 operating budget for PAACS to train 35 residents was $460,000. This does not include the housing and medical care provided to the trainees by the hospitals in which they received their training, and it does not put a value on the donated time of administrative personnel and missionary surgeons. The PAACS continues to face many challenges. The entire operating budget originates from private donors. There is a shortage of long-term faculty. One program in Cameroon was forced to close after the program director returned to the US. A second program in Cameroon was recently closed when the hospital demonstrated during the probationary period that it was unable to meet the conditions of the memorandum of understanding, making training impossible in that setting. Nine new training programs could open in the next few years if long-term faculty were in place. As the current programs continue to succeed in producing skilled surgeons, PAACS graduates will be recruited to serve as PAACS faculty as the program expands. However, surgeons gifted as teachers and educators have been a small proportion of the trainees. Those trainees who seem to have an interest are actively encouraged to consider this option and are mentored to improve their skills. Such candidates are placed in a PAACS teaching hospital after graduation in order to encourage and mentor them. The recruitment of high quality trainees has also been difficult. Top quality candidates often choose to train and emigrate to the West, or they choose medical specialties such as infectious disease to obtain high-paying jobs with NGOs.

There are three established colleges of surgery in sub-Saharan Africa. The West African College of Surgeons was established in 1962 and has 18 member nations. Cameroon and Gabon are members of WACS, but there were no general surgical training programs prior to PAACS in these two countries. The College of Surgeons of East, Central, and Southern Africa was founded in 1999, since the start of PAACS, and it has 9 member nations. The South African College of Surgeons exists only in South Africa. There are

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**Table 2** The classifications of cases performed by trainees by specialty

<table>
<thead>
<tr>
<th>Specialty</th>
<th>Percentage of total cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>General surgery</td>
<td>38</td>
</tr>
<tr>
<td>Obstetrics and gynecology</td>
<td>32</td>
</tr>
<tr>
<td>Orthopedics</td>
<td>15</td>
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**Curricula and includes additional areas that are deemed to be important.** The Surgical Council on Resident Education curriculum, developed by a consortium of surgical societies and adopted by more than 180 US surgical training programs, has recently been approved for inclusion and is being modified and instituted in the PAACS training program. Surgery in Africa truly is the “skin and its contents” (Table 2), and therefore PAACS has set up specialty task forces to help train general surgeons in specific areas. The PAACS task forces in the common subspecialties are creating specialty-specific curriculum modules to provide material specific for Africa.

Given the paucity of surgical subspecialists in all fields, there has been some pressure to expand general surgery training programs into other specialties (particularly orthopedics, obstetrics and gynecology, and urology, which represent a large percentage of cases). True specialty training programs are a goal of the future, when resources are greater and the training of the general surgeons is satisfactory. At present, the only exception for PAACS is in the area of general pediatric surgery, because Africa has the highest percentage of the population under 15 years of age of any continent [22]. The PAACS program in Kenya is one of only two COSECSA-accredited training programs in East, central, and southern Africa.

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a number of African countries that do not belong to any college of surgery, and those countries set their own standards. In the rural environment where most mission hospitals exist, any physician can perform any procedure that he or she is capable of, and much surgery is done by nurses and technicians. It was in this environment that PAACS was born. It has accepted the logic of training técnico de cirurgias, but was aware through past experiences of the potential limitations of that system. The original vision of PAACS, therefore, was to train excellent surgeons without being concerned about the level of certification. However, PAACS subsequently became convinced of the professional and personal advantages of proper recognition and therefore continues to seek full accreditation from the African colleges, COSECSA, and WACS. The success of the accreditation process to date has been limited by deficiencies in hospital resources and personnel. To assure that its graduates will continue to be able to practice with full recognition by the local and national governments, PAACS is also seeking accreditation from the local ministries of health within each country. This process is ongoing and represents the desire of the PAACS leadership to maintain a training program compatible with local health authorities and not be seen as a competing educational system.

Selection and retention of residents is an issue for PAACS as it is for its US counterparts. The brain drain has limited the quality of the applicant pool, and the difficulty and expense of traveling makes face-to-face interviewing impractical. The application process is carried out in written or electronic form and cellular phone interviews are made. The attrition rate of 18.5% is comparable with those of American training programs, and the reasons that trainees leave a program are similar [26]. Unfortunately, there is a lack of data regarding attrition rates in African training programs, but the challenges faced in the pursuit of surgical training are found across the continent. Multiple attempts to pass certification exams of the African Surgical Colleges by African surgeons are common.

There are many issues facing PAACS for which acceptable answers have not yet been found. Sustainable finances and personnel is the ideal. Realistically, however, it may take one or more generations, a revision of medical education, and a major economic revival to accomplish these goals. An increased level of support of the PAACS graduates is desired, but with each graduate who returns to an underserved and failing rural hospital, the demand for resources to support that surgeon professionally increases the need for resources asymptotically, because that implies support of that hospital and the patients’ care. It is unlikely that PAACS will be able to meet all of those demands by itself. The solution must ultimately be found at multiple levels—personal, organizational, country-wide, and worldwide. Western surgeons who wish to help must determine for themselves how they can personally give thought, time, and money. Surgeons should also encourage participation in the solution of these problems by organizations to which they belong, encouraging them to partner with their counterparts in underdeveloped areas of the world.

As evidenced by the difficulties in recruiting and maintaining a surgical presence, surgery in rural Africa is very difficult. Financial remuneration is usually a motivating factor for work in difficult situations, but substantial, sustainable resources are unlikely to be available in rural Africa in the near future. To help overcome the existing problems, PAACS has instituted a leadership and worldview-based curriculum to help trainees prepare for leadership roles in the hospitals and communities they eventually serve, and to give them conceptual and philosophic resources to cope with the challenges inherent in their service in rural Africa.

Delivering surgical care in Africa remains a daunting problem. We believe training surgeons is essential for building the surgical workforce and ultimately improving surgical care across the continent. Humanitarian missions and task shifting will likely continue to be needed for the short-term, but the fully trained general surgeon is the key to surgical care in Africa.

References


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