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Impact of Parallel Anesthesia and Surgical Provider Training in Sub-Saharan Africa: A Model for a Resource-poor Setting

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Abstract
Background The lack of appropriate numbers of anesthesia and surgical care providers in many resource-poor countries around the world, especially in rural populations, prevents adequate care of the large numbers of patients who require surgery in these settings.
Methods This article provides a 10-year review of a rural hospital located in East Africa which developed a training program based on parallel training of anesthesia and surgical care providers. We report the process of building the foundational aspects of a customized medical education program that addresses specific concerns related to the work in a rural African context, which may be very different from medical care provided in the urban settings of low income countries (LIC). We analyzed how the parallel training can provide the clinical tools needed to have a practical impact on the surgical burden in rural Africa.
Results The parallel training program combining training of nurse-anesthetists with the training of multiple levels of surgical care providers, from interns to fellows, led to a fourfold increase in the number of surgical cases. Surgical subspecialty training and the development of an anesthesia care team with anesthesia consultant(s) oversight can serve to maintain a high level of complex and expanding surgical case volume in a rural African hospital setting.
Conclusions This model can be applied to other similar situations in LIC, where the anesthesia and surgical care can be coupled and then customized for the unique clinical rural setting.

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Introduction

The current numbers of anesthesia care providers in low income countries (LIC) are unable to provide the necessary safe and effective anesthesia services needed to adequately manage their portion of the 234 million major surgical procedures occurring annually worldwide [1–3] At this time and based on the record of the last 20 years, most LICs do not and will not have the numbers of trained physician anesthesia care providers required for their countries' specific surgical burden, if the model for coverage is consistent with anesthesia coverage standards practiced primarily in resource-rich countries [4]. The lack of adequate numbers of training programs; the insufficient numbers of graduates of medical schools in LIC who choose anesthesia; the shortage of proper training materials, including anesthesia books and training modalities; the lack of academic educational partnerships between resource-rich and resource poor countries; the lack of adequate basic medical infrastructure that would promote an anesthesia educational center; and the lack of alternative anesthesia care provider training models would each individually, but certainly collectively, contribute to the overall lack of anesthesia care necessary for the millions of patients in LICs [2, 4–8]. Additionally, many patients who require surgery may fail to obtain anesthesia, because there is also a major shortage of trained surgical care providers in many LICs [9–12].

Although the numbers of medical students who choose a career in surgery rather than anesthesia is higher, the actual number of surgeons trained in Africa is still far below the

needs of their respective countries [4, 7, 9, 11, 13]. Many hospitals, especially in the rural sector, have insufficient physician surgical coverage for even the most basic of surgical services needed at the district hospital level [14, 15]. In many LICs the basic surgeries such as caesarean section, tubal ligation, abscess drainage, and hernia have to be managed by non-physician surgical care providers because of the lack of trained surgeons [16, 17]. The overall deficit in the number of surgical specialists (in orthopedics, pediatrics, and others) alongside the overwhelming surgical burden with advanced surgical pathology presents a "perfect storm" as medical care relates to surgical care. The surgical burden in LICs demonstrates an advanced surgical pathology collection, fewer trained surgeons specialists, less medical infrastructure and thus, in comparison to Western figures, a consistently higher multifactorial surgical and anesthesia mortality, which thus far has been difficult to document [18–20].

The manpower shortages in anesthesia and surgical provider care in LICs compounded by the urban-to-rural physician distribution inequities within individual countries and regions prompts us to look at a model for anesthesia and surgical delivery for these settings [9, 11, 14]. Although the specific numbers are not available, we must assume that if the discrepancy between skilled health personnel who attend a live birth in the urban and rural sector in Africa is documented as being vast, then the lack of anesthesia and surgical care must be equally, and perhaps even to a greater degree, alarming [21] (Fig. 1). This is not in contrast to many resource-rich countries where the vast majority, 90%, of surgeons still practice in the urban settings of the United States [22]. This fact of concentration of the surgical and anesthesia team toward the urban setting will not change, so we must develop a strategy to manage the surgical burden for LIC, especially in the rural sectors,

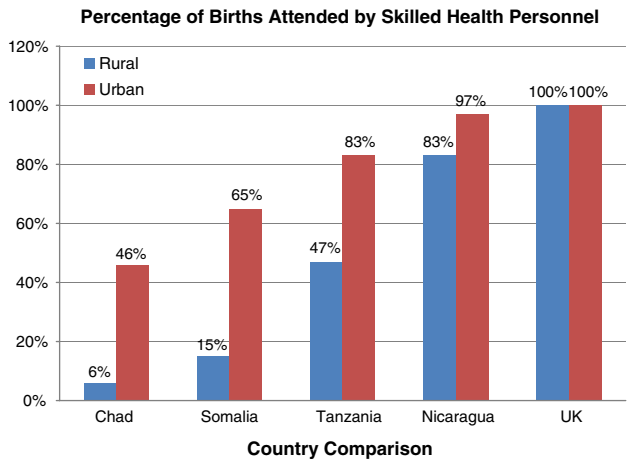

Fig. 1 Percentage of births attended by skilled health personnel, Kijabe Hospital, Kenya

where 40–50% of the population reside, producing an equivalent surgical burden but where less than 10% of the specialist physicians live and work [9].

Materials and methods

Anesthesia development

The WHO Africa regional health statistics, which demonstrate a region with the highest maternal mortality rate, under-five mortality rate, and the fewest skilled health care providers, provided the needs assessment prompting an initial anesthesia survey in a rural hospital in the country of Kenya [21]. In 1995, an anesthesia needs assessment was obtained at a church hospital located one hour north of the capitol city of Nairobi. Kijabe Hospital, founded in 1917, is a regional referral hospital with approximately 250 beds, which historically has been a surgical hospital for this area of Kenya. The hospital has an electricity cable, diesel-powered generator, fresh water supply, piped oxygen system, relative security, and a developed supply infrastructure that allows for "in-country" procurement of basic anesthesia and surgical supplies. These often overlooked aspects of establishing a training center were, in hindsight, foundational pillars for the goals of developing an anesthesia and surgical educational center in rural Africa, which are often lacking in many rural African hospitals [2].

The assessment reinforced the knowledge that physician care providers are few in number, primarily working in the urban sector for many reasons that are beyond the control of the trained specialists, and that the surgical burden in this rural area of Kenya has not been appropriately managed by the current anesthesia workforce [23]. The assessment also concluded that Kenyan registered nurses were capable, with adequate training and proper supervision, to form an integral aspect of the anesthesia care team as task sharers [24]. The RNs have an educational foundation of basic sciences and extensive inpatient clinical care, two bases that provide the necessary foundation on which to build. The assessment also determined that the typical North American or European anesthesia training model needed to be adapted to the medical environment in this area of rural Kenya. It became obvious that the numbers of anesthesia care providers must be increased to match the existing numbers of surgeons already practicing in Africa [25]. The assessment concluded that the following areas of anesthesia training would be emphasized: obstetrics, trauma, pediatrics, and regional anesthesia to a much larger extent than would be the case in a resource-rich country anesthesia training setting [26–28].

A basic anesthesia infrastructure was developed that included transporting refurbished anesthesia machines,

pulse oximeters, cardiac monitors, operating room beds, and general operating room equipment from donor, resource-rich counties to our location. The equipment was serviced prior to its delivery, with the understanding that the equipment needed to be appropriate for the electrical variations common in LIC and protected from power surges, which can destroy the electronics of the equipment in seconds. When attempting to use modern anesthesia and surgical equipment in rural Africa, the biomedical technology aspects of sustainable monitoring equipment brings multifaceted issues that must be addressed with supplemental and appropriate (less cutting edge technology) training of national biomedical technicians. All anesthesia training programs in the resource-poor countries should include basic maintenance of anesthesia equipment as part of the curriculum.

The level of nurse anesthesia training was to be at the RN level, and a competency-based Kenya Registered Nurse Anaesthesia (KRNA) Curriculum was developed alongside the official Kenya nursing education body. Although the entire curriculum and approval process was time consuming, requiring 4 years, the foundation of working within the national health system was required for sustainability. The training of non-physician anesthesia care providers in the United States, Europe, and other countries in Africa is well established [2, 5, 6, 16]. Based on personal experience in rural Africa, registered nurses were appropriately trained in basic sciences and clinical care foundational principles, equipping them to then obtain anesthesia-focused training. Partnering with the national anesthesia physician educators was ongoing, because their insight was necessary to develop a program appropriate for the East African setting. Approval of a curriculum that meets the education standards of the country of training allowed for a partnership and "ownership" to help sustainability and acceptance of this new area of training in anesthesia care. In addition, a curriculum that allows flexibility in training could, in the future, be useful for regional (East Africa) training programs that are not country specific, and this aspect of the curriculum was equally important.

Although comprehensive, the curriculum emphasized four areas deemed necessary to match the surgical pathology, population demographics, resource availability, and the appropriate anesthesia care that would be the safest for rural Africa. Africa has the highest maternal mortality ratio (Africa 1:16 versus United States 1:4,800) in the world; the greatest difference between skilled birth attendants (urban/rural), and a high total fertility rate [21]. Cesarean sections are the most common surgical procedure performed in the majority of rural African hospitals, and the most common cause of maternal death in Africa is hemorrhage [29]. Equally important when considering obstetrical anesthesia care education is the ability to resuscitate the newborn [30]. Birth asphyxia may account for 24–29% of neonatal deaths in a resource-poor setting [31, 32], and neonatal deaths account for approximately half of infant deaths in Africa [33]. Obstetrical anesthesia care and newborn resuscitation provided the first foundational pillar of our rural Africa nurse anesthesia curriculum.

Although data that would help determine the exact numbers of pediatric patients who need surgical care in Africa are not available, it is estimated that 40–50% of the population is younger than 15 years of age. Thus pediatric surgical admissions may account for up to 10% of the overall surgical numbers, and the under-five mortality is very high in Africa (approximately 200/1,000) [21, 28].The numbers of trained pediatric anesthesia specialists are low and concentrated in urban settings, thus prompting the second pillar of the nurse anesthetist curriculum development.

Trauma is a major cause of injury in the world, and in developing countries it is estimated that five million trauma deaths occur each year, roughly equal to the number of deaths from HIV/AIDS, malaria, and tuberculosis combined [27]. More than 90% of trauma deaths worldwide occur in low- and middle-income countries, where the infrastructure is much less capable of handling emergencies that are routinely managed in more developed countries [27]. The cost-effectiveness of surgical treatment of trauma patients was evaluated in a district level Cambodian hospital and showed that, with the addition of a few resources, lives can be saved [34]. In Kijabe Hospital, approximately 70–75% of all orthopedic cases are trauma related, and although many are acute trauma, others are delayed referrals from smaller district level hospitals. Anesthesia for trauma and a special emphasis on orthopedics was our third training area of focus.

With proper training and the necessary equipment, regional anesthesia safety for cesarean sections has been well established. The abundance of trauma and associated orthopedic procedures; the lack of extensive blood banking services; and the situation in many rural African hospitals that have a paucity of trained post-anesthesia care personnel, we decided to emphasize regional anesthesia training in our curriculum. We directed our regional anesthesia training to spinal anesthesia, but peripheral nerve blocks were also taught. The decision to train equally in regional and general anesthesia was in contrast to the standard practice in many surgical settings in Africa, where general anesthesia is the primary form of anesthesia care [19].

Five rural Kenyan hospitals, including Kijabe Hospital, were chosen to help improve the anesthesia services for these hospitals' patient populations. Each hospital determined its specific anesthesia personnel needs, and

candidates were recruited for the training program based upon the following requirements: RN level, minimum of two years clinical nursing experience, acute medicine interests, preferred experience in the operating room environment, and willingness to enter into a bonding agreement with the sponsoring rural hospital. All of the students had long-term relationships with the individual hospital administrations and a hospital/community committee that was led by the senior surgeon in that hospital. Based on our experience, the cultural implications for a geographical region could have a significant effect on the sustainability of an individual within an anesthesia care service. Our desire was that each community and hospital would "send" their person, who would then be accepted back into that community to work, understanding all of that specific community's cultural facets.

The program consists of basic computer skills training, morning and afternoon lectures, daily clinical training with log books, case reports, problem based learning discussion (PBLD) sessions, ICU rotation, direct supervision by anesthesiologist(s) and graduate KRNA students, including trainee and teacher evaluations. Each student is required to develop a basic clinical research anesthesia project to be completed over the 15-month course length. Students are given practical exams in preoperative assessment, general anesthesia, and regional anesthesia by external volunteer examiners, primarily from North America. The students must pass institutional exams before the Kenyan National Examination under the authority of the Nursing Council of Kenya, which certifies their postgraduate training in anesthesia.

Surgery development

Surgical colleges in the resource-rich countries of North America, Europe, and Australia provide training in multiple specialist areas. These highly skilled surgeons practice only within their area of expertise, with excellent outcomes as a result. The Royal Australasian College of Surgeons, for example, has 9 specialty training programs with just under 5,000 surgeons providing care for a population of about 22 million. In 2008, there were 1,660 specialist-trained general surgeons (STGSs) in Australia, a general surgical ratio of 1/13,250 population. World Health Organization Guidelines suggest a ratio of (whatever) is optimal for a country.

By sharp contrast, resource-poor sub-Saharan African countries have far fewer trained surgeons per head of population, and most of these are not trained in a surgical specialty. In Uganda for instance, the STGS ratio is 1/400,000 population [9]. In Kenya the STGS ratio is better, but still far short of international standards. In many sub-Saharan countries, this ratio is far worse; for example, it is estimated there are only two STGSs for a population of about 4 million in the northern Somali province of Somaliland. In addition, in these countries the STGS is also expected to be the neurosurgeon, the urologist, the thoracic surgeon, and the orthopedic surgeon, as the clinical situation dictates.

Some of the factors that may contribute to the growing surgical needs in LIC are listed here:

- Low training numbers of specialist surgeons
- Small number of training positions for the population
- Long training programs
- Poor remuneration in government hospitals (versus private/overseas)
- Poor equipment in government hospitals (versus private/overseas)
- High risks of blood-borne diseases
- Gravitation of specialists to urban areas
- Emigration of specialists overseas
- Rural areas harbor majority of population but minority of specialists
- Western-trained specialists unfamiliar with African pathology

Kijabe Model helps global burden of surgical disease (GBSD) by:

- Training African specialists in African pathology
- Adequate remuneration for its trainees and graduates
- Partnering with resource-rich countries/hospitals for equipment/supplies
- Partnering with ex patriot specialists for continuing medical education (CME) and professional camaraderie

Kijabe Hospital has committed itself to be seriously involved in surgical training in Kenya and the region. Up until 2007, general surgical training in Kenya was a Masters of Medicine (MMed) accredited through the University of Nairobi (UoN). This 4-year program included one year of research and three years rotating through general, orthopaedic, and other specialty units, with a total of 18 months only in general surgical units. Only a small number STGSs have graduated from this program each year. Orthopedic, neurosurgical, plastic, and urological specialty training has been unavailable in Kenya through the MMed program.

In 2006, Kenyan authorities approved a new professional accrediting body for surgical training, the College of Surgeons of East, Central and Southern Africa (COSECSA). Kijabe has applied and been accepted as a full 5-year FCS training site in general, pediatric, and orthopedic surgery in the COSECSA program, the only Kenyan facility to have three specialty training programs.

Results

A total of 18 KRNA graduates or trainees, 7 from Kijabe Hospital, have, or will soon, complete the nurse-anesthetist program. Of interest, 100% of the graduates of the program are still working in the rural African hospitals that sent them for training. The case number (66/month/student) and case distribution provide good clinical experience (Table 1).

The 2006–2008 KRNA training surgical case distribution consisted of an age distribution that represents the population demographics. The large number of non-elective cases, 41% of the total, reinforces that injuries and other delayed presentation urgent surgical cases have a great impact on the surgical burden in low income countries (Table 2).

During this 10-year period, a total of 55 intern-level physicians have been trained to safely perform a cesarean section, the most common procedure in rural African hospitals [14, 19, 20]. Seven (7) surgically based medical officers have also been trained: general surgery (2), obstetrics/gynecology (1), orthopedics (4). Many of these surgeons have now entered or have completed advanced training programs in Africa and now function as consultants at Kijabe Hospital. The surgical and anesthesia educational strategy at Kijabe Hospital has been to support those individuals who were primarily interested in rural surgical care in Kenya or the region. During this time period, we have assisted only one surgeon in obtaining advanced surgical training (plastic surgery) outside the African continent. This student was not accepted into a program in South Africa but was accepted into two other programs (Spain, India) and will be at Kijabe as the first fully trained Kenyan plastic surgeon in the country. His goal is to expand surgical care for the patients with burns, trauma, and congenital anomalies, in a partnership program with his plastic surgery colleagues from Spain.

The hospital is an integral part of the training of family practitioners and has trained four of these physicians in surgery skills needed to manage a district hospital level surgical burden. In 2009, the hospital's surgical training provides the following surgically influenced residency programs: general surgery (2), orthopedics (2), family practice (2), and a fellowship program in pediatric surgery with two fellows from countries outside Kenya where there are no pediatric surgical training programs. As has been true for the anesthesia nurse applicants for the training program, many of the surgical trainees are interested in rural surgical care in Africa. The vast majority of these residents have completed a medical student elective program followed by an internship at Kijabe Hospital. These periods of training have provided an opportunity for the trainees to decide if they would prefer advanced training at Kijabe Hospital, and their experience within the hospital also allows the medical staff the opportunity to develop relationships with these future trainees. From 1995 to 2008, the total numbers of anesthesia care providers and surgical specialists at Kijabe Hospital have increased in a parallel fashion.

Over the 10-year period of the training program, the hospital surgical case load has continued to increase, following the parallel and trajectory pattern demonstrated by the upward slope (Fig. 2). The trend indicates that the case load for 2009 will be over 10,000 cases for Kijabe Hospital's five-room surgical complex. Although not assessed, the complexity of the surgical case load tends to be increasing as the surgical and anesthesia care improves and multiplies, possibly helped by the addition of a five-bed basic ICU. Also, the significant increase in the numbers of

Table 1 Percent nurse anesthesia case distribution

General	20
Orthopedic	20 (72% trauma; 23% less than 15 years of age)
Obstetrics/gynecology	20
Pediatric surgery	8
Neurosurgery	20 (92% <6 months of age)
Thoracic/burns/ENT	2

Table 2 Nurse anesthetist training areas, percentage distribution

General anesthesia	46 (85% with endotracheal tube)
Regional anesthesia	47 (86% spinal; 14% peripheral nerve block)
Ketamine	7
Non-elective cases	41
Less than 15 years old	42
Less than 6 months old	9

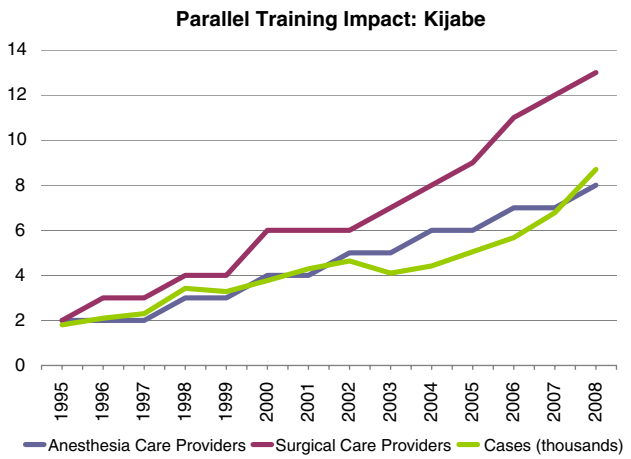

Fig. 2 Parallel training impact: Kijabe Hospital

pediatric cases is testimony to the development of a pediatric surgical service that includes pediatric neurosurgical cases in staggering numbers.

Discussion

The sub-Saharan Africa surgical share of the 234 million annual operations in a global environment that does not equally distribute the necessary tools enabling the medical care providers in these countries to "carry their burden" needs to be addressed. The WHO estimates that countries with fewer than 23 health care professionals (physicians, nurses, midwifes) per 10,000 population will be unlikely to achieve adequate coverage rates for the key primary health care interventions prioritized by the Millennium Development Goals (MDG) [35]. In the WHO African Region, the total number of physicians, nurses, and midwifes per 10,000 population is approximately 13, and for many areas it is fewer than 10 [35].

These global inequalities in health care services are most pronounced in the sub-Saharan Africa Region. Now, with the 2007 report that sub-Saharan Africa is not on target for any of the WHO Millennium Development Goals, we need to look for models to assist in the development of customized surgical and anesthesia services. These models will appear dissimilar from many programs offered in resource-rich countries, but they may provide a flexible template that will allow safe and effective management in LIC surgical settings within the clinical environment that, unfortunately, will be present for the next decade or more.

Severe shortages of trained health care professionals, specifically anesthesiologists and surgeons, throughout many areas of Africa represent fallout from complex social, economic, and political factors that can be expected to continue for decades before a major impact is seen. Africa is the only continent where the absolute numbers of trained anesthesiologists decreased in the 1990s [6]. If the total number of graduates entering surgical training in African universities continues to be lower than the assessed needs, then the shortage will certainly persist [9]. In some African countries the surgeon ratio is 1/400,000 population, and the anesthesia mortality rate has been addressed to be as high as 1:150 anesthesia procedure, which gives us a clear view of the current clinical picture [12, 23]. The likelihood that these statistics will worsen as a result of factors that, at times, are beyond the control of the national training programs and are more economy driven, reflects what appears to be a troubling trend [9]. The gross disparities demonstrated by the estimate that the richest 30% of the world's population receives 75% of the surgical care and the poorest third receives only 3.5% of the global number of required surgical procedures prompts us to search for solutions [13]. Although these numbers indicate a vast surgical care divide between the richest and the poorest, they may yet underestimate the severity of the problem, as many countries do not have the infrastructure capacity to give adequate surgical and anesthesia reports. The authors have visited many countries in East, Central, and the Horn of Africa where basic medical record keeping of basic vital signs and drug lists are not practiced. In such settings, an estimate of the surgical burden would be, at best, a guess.

Although comparison of the numbers of trained surgical and anesthesiology specialists in resource-rich and resource-poor countries reveals a situation that appears hopeless, this clinical picture becomes even gloomier when we compare the numbers of trained specialists within a specific country who work in the rural sector compared to the urban setting. In the United States and in most African countries, 90% of the specialists work in urban clinical settings [22]. WHO reports that in half of the countries of the world child mortality rates are at least 1.4 times higher in rural areas than in urban areas [21]. Also, in 64% of countries the proportion of births attended by skilled personnel is at least 20% higher in urban areas than in the rural setting [21]. Although exact numbers are not known, the anesthesia and surgical mortality rate disparities between urban and rural African settings are likely equally dramatic [18, 19]. The MDG will never be reached for MDG 4 and MDG 5 if this divide persists for a patient population that demands 40–50% of the surgical load alongside advanced surgical pathology and reduced hospital infrastructure (electricity, water, supplies, drugs) when compared to the urban environment [2, 35].

This African rural referral hospital, WHO Level 3, fashioned a parallel anesthesia and surgical training scheme designed to meet a specific surgical burden that covers a wide geographical area. Although the referral area comprises a large rural sector, many patients are referred from urban areas within the country or from neighboring countries in East Africa and the Horn. The already burdensome surgical load had continued to grow as the surgical and anesthesia services developed. Surgically, we were able to influence medical students early by exposing them to surgical specialists who demonstrated skill and expertise in providing quality surgical care with limited supplies supplemented with a measure of donated basic surgical equipment. These medical students have gone on to become Surgical Medical Officers, registrars in general surgery, obstetrics, and orthopedics. Six of them have now returned to their "medical home," as surgical consultants working in the rural sector of Africa. To ensure success, we certainly will need to address such issues as education for physician's children; maintaining appropriate salaries for national consultants from a hospital with a patient

population that is poor; and providing opportunities for surgical CME and international partnerships. All this must be done as we assist these physicians in addressing the multitudes of environmental and cultural facets associated with living in rural Africa. Many of these surgeons are broadly trained to handle a wide range of surgical issues common to this patient population, and very few of their patients are referred to Nairobi for surgical care.

With the program established to accommodate the surgical load, a parallel Registered Nurse Anaesthesia Program was developed to help address the low numbers of anesthesia consultants and even more significantly, the lack of adequate anesthesia care providers in the rural sector. The comprehensive 15–16-month training program emphasizes regional, pediatric, obstetrical, and trauma anesthesia skills, the most important surgical services in this rural patient population base. Reflecting the local demographic, the case load volume includes 45% of patients younger than 15 year of age. Also, there is a significantly higher percentage of regional anesthesia cases (46%) than was previously reported in other anesthesia descriptions from Africa [19]. The educational mandate to teach regional anesthesia properly for the rural setting where general anesthesia drugs and supplies, electricity, recovery room personnel, and oxygen are not always available, led to a high volume of spinal anesthesia cases, thus improving the safety issues often associated with spinals. This training has been accomplished with significant and direct consultant anesthesiologist oversight, which is not always the case in training. This model does not eliminate the need for anesthesiology consultants but allows for an anesthesia care team and "task sharing" or "anesthesia extenders" to be developed so that the anesthesia service can cover more surgical volume.

The case volume for this rural approximately 250-bed hospital had a fourfold increase from 1,980 patients in 1995 to 8,300 in 2008, the period of this review. The surgical numbers for 2009 should be over 10,000 cases. In comparison to a similar-sized hospital (Lira) in rural Uganda, Kijabe Hospital has an 8 times greater surgical volume [9]. This very high surgical volume can be attributed to several positive factors: (1) the return of some Kenyan surgical consultants to the "medical home" post-training, (2) the presence of significant numbers of well-trained registered nurse anaesthetists and students, (3) a highly motivated theatre staff who take pride in providing surgical care for their fellow-citizens, and (4) a Kenyan hospital administration whose integrity allows for proper accounting with minimal Western funding except for the volunteer medical specialist's working hours. The sustainability of a program such as this can only be accomplished by working alongside the national surgical and anesthesia educators and seeking their wisdom for improvement and direction.

The need to build surgical care capacity in low-resource countries needs to be a priority with global funding bodies. At the local level, we need to get the data required to convince the global funding agencies that surgical and anesthesia services are key components of any global public health agenda. Current funding patterns, where HIV, tuberculosis, and malaria receive the bulk of the funding, send the message that the overwhelming surgical burden is lower on the priority list than these other issues. Partnering between academic universities in resource-rich and resource-poor countries is important, so that collaboration can begin to address the surgical and anesthesia needs from different, equally important perspectives. Similarly important, the education of faculty, residents, and fellows in anesthesia and surgical training in the resource-rich countries will allow for a new and energetic wave of international anesthesia and surgery "levellers" of the global disparities. The issues are complex, but the needs are obvious to those who work in LIC, and we need to look for methods and resources that will slowly improve the dismal surgical numbers currently distributed by the WHO. The parallel anesthesia and surgical training model located within this unique clinical smorgasbord of rural Africa has produced a team (surgery and anesthesia) that can work together to tackle the surgical burden. As is so often the case in rural Africa, the community or village all share the highs and lows of life as one unit. This image of carrying a heavy load should remind us to apply this model, and perhaps proven others, for the millions of patients in resource-poor rural Africa who need safe and effective anesthesia and surgical care. Partnering with our African anesthesia and surgical colleagues will allow all of us to become stronger and more capable of caring for our patients.

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