



Scaling up a Surgical Residency Program in Rwanda

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Background: Beginning in 2012, the Government of Rwanda implemented the Human Resources for Health (HRH) program to enhance capacity building in the Rwandan health education sector. Through this program, surgical training at University of Rwanda (UR) has expanded. The aim of this presentation is to describe the scaling up of the UR surgical residency program

Methods: We performed a descriptive analysis of the UR surgical residency program after initiation of the Rwanda HRH Program.

Results: Through the HRH Program, faculty from US institutions supplements the existing Rwandan educational infrastructure to increase the teaching capacity in Rwanda. Intake of surgical trainees more than doubled within the first year of the program. Service-based surgical training has changed to competency-based training through curriculum development, dedicated academic days and surgical education within firms. Lectures remain a dominant feature of the educational program, but more focus is placed on bedside teaching and peer-education. Shortage of operative space and a tremendous number of emergency patients overwhelm public teaching hospitals posing a challenge towards providing residents with a broad spectrum of operative experiences, especially elective surgical cases.

Conclusion: Through this program, the surgical residency program has greatly expanded. Over time, the quantity and quality of surgical residents is expected to increase.

Introduction

Many countries in sub-Saharan Africa (SSA) struggle with a shortage of physicians, including surgeons. It is difficult to accurately quantify the unmet surgical need in SSA, though studies have shown a high need with relatively limited access to surgical care^{1, 2}.

To counteract this shortage, many countries are developing or expanding local training programs, both at the undergraduate and graduate level³⁻⁵. One such example is the College of Surgeons of East, Central, and Southern Africa (COSECSA), which, in partnership with the Royal College of Surgeons of England and the Royal College of Surgeons of Ireland, developed a surgical training program with several sub-specializations⁶. The program is administered through national surgical societies in 9 member countries in SSA^{7, 8}. Advantages of developing local training programs include a decreased risk of "brain drain," teaching trainees about locally relevant pathology and providing medical care to the local population³.

Through collaborations with universities in high-income countries (HICs), many local training programs are growing^{3, 5, 9, 10}. Partnerships with universities and professional

societies in hics provide a quality control element, increased faculty presence and supervision, access to learning resources and oftentimes an external funding source⁵. While the nature of these partnerships varies considerably, many of the experiences are similar.

Rwanda is a small, land-locked country in East Africa. With a population of 11 million, it is the most densely populated country in Africa¹¹. In 1994, the country was devastated by genocide. In the aftermath, Rwanda's under-5 mortality was the highest in the world, while life-expectancy after birth was lowest in the world^{12, 13}. Since that time, Rwanda has worked tirelessly to change this and today reports improved health statistics in all fields¹²⁻¹⁴. Despite these advances, there remains a shortage of physicians and other trained healthcare staff with 0.056 physicians per 1 000 population^{13, 15}.

The medical system in Rwanda is a tiered structure with 60 health posts, 451 health centers, 41 district hospitals and 5 referral hospitals¹⁶. The patients initially present to local health posts or to the health centers staffed by non-physician health care workers. They are then referred to district hospitals staffed primarily by general practitioners. From there, they are referred to provincial or referral hospitals. In total, there are approximately 50 full time surgeons working in Rwanda with most specialists working at referral hospitals¹⁷.

Surgical training in Rwanda started in 2005 when the University of Rwanda (UR) (formerly National University of Rwanda) developed residency programs in an effort to increase the number of specialists in Rwanda. Before this time, surgeons and other specialists were trained outside of Rwanda, in places such as South Africa, West Africa, East Africa and Europe.

In 2011, the Rwanda Ministry of Health (MOH) embarked on a strategy to fill the human resources for health gap to improve access to health care for the growing population. A special collaborative, the Rwanda Human Resources for Health (HRH) Program, was initiated in 2012. Among other aims, the program's goal is to increase residency training in internal medicine, pediatrics, obstetrics/gynecology, anesthesia, otorhinolaryngology and surgery¹⁸. Through this program, faculties from various partnering US institutions are recruited to twin with local Rwandan colleagues to strengthen the educational system. In surgery, the ultimate goal is to staff a general surgeon in each district hospital. Orthopedic surgeons, neurosurgeons and urologists will work primarily at provincial and referral hospitals. As more collaborations and twinning programs develop between low- and middle-income countries (LMICs) and HIC universities, it is important to learn from these experiences. We describe the experiences and lessons learned from the UR surgical residency program in the first years of the Rwanda HRH program.

Methods

We performed a descriptive analysis of the UR surgical residency after initiation of the Rwanda HRH program. The domains analyzed include the structure of the residency program, teaching faculty, patient care, education strategies and operative experience. We provide a description of the experience, challenges and lessons learned through

scaling up the UR surgical residency program through the assistance of the HRH program. Key challenges and lessons learned are compiled in Table 1.

Results

Structure of the Residency Program

Before

Prior to the HRH program, the UR general surgery residency program was a 4-year Masters in Medicine program, requiring a thesis and dissertation defense upon completion. The subject material was broad-based, covering general surgery, orthopedics, neurosurgery and urology. After completion of training, some graduates began practice immediately, whereas others pursued further surgical specialty training outside Rwanda. Despite the fact that there were 10 MOH scholarships available for surgical positions, an average of 2-6 residents was enrolled annually before the HRH program (Table 2).

After

The initiation of the HRH Program brought about a review and restructuring of the residency program with the aim of increasing both the number of trainees and the number of surgical specialties in Rwanda. UR now offers surgical residency training in four specialties: general surgery, orthopedics, neurosurgery and urology. Curricula were developed for each of these specialties, as these were all new training programs. Curricula were locally developed, but modeled on curricula from other programs, focusing on topics deemed relevant to Rwanda^{7, 19, 20}.

The general surgery residency is still 4 years while the other training programs are 5-6 years each. All residents participate in a 1-year basic surgical training course with special reference to basic sciences and basic surgical skills (Figure 1). This is followed by 3-5 years of specialist training. Residents rotate at four different referral hospitals and plans are underway to incorporate rotations at provincial and district hospitals. The initial focus has been directed towards basic surgical principles and management in the first 2 years of program inception. Over the next 1-2 years, further program development will focus on more advanced training targeted towards senior residents. A total of 20 surgical resident positions are available each year: 10 in general surgery, 5 in orthopedics, 3 in urology and 2 in neurosurgery (Figure 2). The majority of surgical residents are male, with a male: female ratio of 18:1. There were 19 postgraduate year (PGY) 1 residents in the inaugural year of HRH. However, in the past two years, approximately half of all trainee positions have been filled, with intake divided amongst the surgical specialties (Figure 3).

The reasons for the shortage of applicants have not been studied, but potential reasons include the requirement to work for 2 years in a district hospital before application, limited surgical experience at the district hospital, lack of interest in the field, heavy workload, work-life balance during the training and remuneration after training. Further studies will need to be performed to determine the exact causes of low recruitment. Suggestions for increasing the number of surgical applicants include increasing surgical exposure at the district hospitals and increasing reimbursement. At district hospitals, there is exposure to specialties such as pediatrics, internal medicine, obstetrics/gynecology and pediatrics. However, there is limited exposure to anesthesia

and surgery. Increased exposure to surgery at the district hospital may stimulate interest in pursuing a surgical career. The dramatic increase in the number of first year residents at the launch of the program created a bottom-heavy hierarchy with many junior residents and few senior residents (Figure 4). It is hoped that with the improved supervision and mentorship, the junior residents will become more experienced and will begin to model behavior for incoming residents.

Table 1. Key lessons learned

Challenges	Recommendations and lessons learned
Residency structure	
Low recruitment of trainees	Increase surgical exposure at district hospitals Increase reimbursement Waive/modify internship requirement
Large increase in junior residents with Fewer senior residents	More focus on basic surgical principles in initial years of program expansion
Faculty	
Shortage of educational faculty	Supplement with visiting faculty
Competing demands on local faculty	Educational coordinator Modify employment terms for teaching faculty Compensation for teaching time
Defining a twinning partnership	Local and visiting faculty twinned via firms Firm curricula defined
Adaptation of visiting faculty to the local environment	Long term commitments and/or returning faculty Hospital/program orientation Clear goals and expectations set
Multiple visiting teams	Create mechanisms to improve communications and relations between various groups
Clinical care	
Organization of patient care	Specialized firms Patient lists Daily ward rounds with faculty member
Measuring outcomes	Operative database M&M conference Develop systems to monitor quality improvement processes
Education	
Variations in success of self-directed learning	Modular curriculum with outline and objectives Reading schedule Core lecture series
Additional educational opportunities	Weekly academic days with journal club, M&M, radiology review, etc Basic surgical skills course Simulation laboratory
Access and availability of information and resources	Development of program website
Resident assessment	Modular exams Annual exams American Board of Surgery In-Training Exam
Medical student education	Faculty-led bedside teaching Resident peer-teaching
Operative experience	
Large burden of emergency cases with a relative shortage of elective opportunities	Increase operating room efficiency. Expand teaching sites Improve/expand simulation exercise
Limited breadth of specialists	Visiting surgical specialists International rotations

Surgical Faculty

Before

There were 30 Rwandan surgical teaching faculty in the referral hospitals in 2012. Only four were UR academic staff while the remaining 26 were employed by the Ministry of Health with limited teaching responsibilities. They are trained in general surgery, orthopedic surgery, plastics, urology and neurosurgery. Most have received training outside Rwanda.

After

With the introduction of the HRH Program, local faculty were supplemented with visiting surgeons. In future years, it is anticipated that the current trainees will become the future generation of educators. However, there is a lag of several years before this can be realistically achieved.

Table 2. Growth of University of Rwanda Surgical Residency Program: Faculty and Residents

Academic year	Local teaching faculty	Visiting faculty		Residents			
		Less than 6 months	Greater than 6 months	PGY4	PGY3	PGY2	PGY1
2011-2012		0	0	6	2	3	9
2012-2013*	30	8	4	2	3	6	19
2013-2014	30	7	4	3	6	17	11
2014-2015	32	6	2	6	17	8	13

*Inception of the Human Resources for Health program

Local faculty is engaged in clinical, administrative and educational responsibilities. Often the educational aspects suffer low prioritization at the expense of other responsibilities. Currently, approximately 10% of faculty is employed by UR with the remainder employed by the MOH. This has posed a challenge as the terms of reference and educational responsibilities differ between employers. Those employed by the UR are responsible for the didactic and clinical sessions for the undergraduate program while the MOH-employed faculty have varying levels of responsibility to the educational program. This dual nature makes it difficult to organize academic activities. The UR and MOH have come up with proposals to stem this challenge, by reorganizing the structure of the teaching hospitals to include an educational coordinator, review of the employment terms to emphasize educational output and compensation of teaching time by clinicians. These initiatives are still in the early stages but promise an improved educational model.

Visiting faculty, many from HICs, provide additional support through resident and student supervision. They also participate in curriculum development and educational activities.

For the inaugural year of the HRH Program, there were 12 visiting faculty for varying periods of time (Table 2). Eight visiting faculty were present for 6-12 months and four were present for less than 6 months, accounting for approximately 20% of the faculty at teaching hospitals. The model envisioned was a twinning model where visiting faculty

partnered with local faculty for educational skills transfer. As there were many challenges developing twinning arrangements, US Institution (USI) faculty were instead twinned to firms, which were comprised of both local faculty and residents. Each firm then implemented a competency-based curriculum with defined evaluation tools.

Visiting general surgeons are employed for a minimum of one year with many choosing to return for consecutive years. This provided support for ongoing projects and promoted the initiation of new projects. Sub-specialists were employed for a minimum of three months. Many of the sub-specialists from the first year of the HRH program returned in ensuing years. Returning faculty assimilate faster on subsequent visits. Given the complexities of adjusting to a new system, visiting faculty are most beneficial when they are long-term and/or recurrent.

The visiting faculty member is given an orientation before arrival to enhance integration. As it can take a significant amount of time to understand and adjust to the local systems in place, new faculty should be briefed on the challenges and limitations of the hospital system prior to arrival. Visiting faculty may not anticipate the limitations in the operating theater which can range from material and staffing resources to bed availability. In addition to the USI faculty through the HRH program, there are many additional visiting surgeons through other organizations who contribute to the UR surgical education program. Developing strong communication links between the various organizations represented is critical.

Clinical Care

Before

Prior to inception of the HRH program, residents were assigned to local surgical faculty and assisted during cases. When on call, they would manage all surgical emergencies, ranging from general surgery, orthopedics, neurosurgery or urology. Major ward rounds occurred once per week and consisted of one faculty surgeon rounding with residents on all patients in a given ward.

After

With the large increase in the number of trainees, faculty and trainees were organized into firms, which have evolved into specialized services based on faculty role and expertise. On these firms, residents and faculty are responsible for all patients. This allows residents to focus on one specialty at a time while ensuring appropriate patient care. Residents are responsible for maintaining a list of all patients on their respective firm. Team members regularly follow up the patients' progress, identify their location, and communicate with each other. An operative database was created which helps track pathologies and monitor outcomes^{21, 22}. This allows easy identification of cases performed by residents, which can then be used for an operative logbook and feedback.

Through firm organization, there has been a subjective increase in ward rounds and patient care on the ward. Patients are more closely monitored, discharged more efficiently and complications identified sooner. Unfortunately, at this point, there are no objective measures of these data points. In future years, more focus will need to be placed on data collection and quality improvement measures.

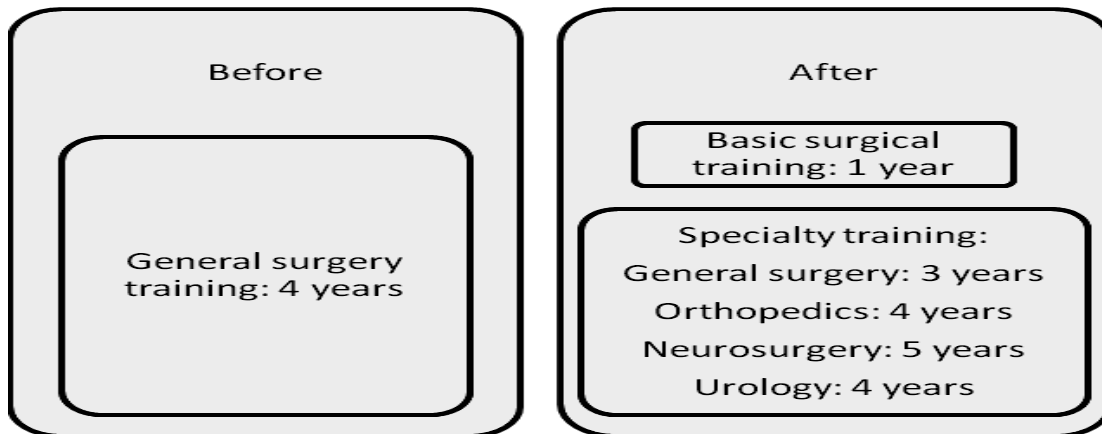


Figure 1. Surgical residency structure before and after scaling up surgical residency training in Rwanda

Education

Before

Surgical training in Rwanda has historically been comprised of self-directed learning. Self-motivated residents were able to guide their learning whereas other residents struggled to manage time well and identify appropriate study materials. Didactic programs were limited by the number of surgical faculty available and examinations occurred annually.

After

Beginning in 2013, a modular curriculum was developed, providing residents with an outline and learning objectives. To supplement the modular curriculum, a series of core lectures is delivered by residents across all teaching sites in a coordinated manner. The modular curriculum has been hard to implement for programs with limited UR faculty. Additional support is needed to ensure the success of the modular curriculum in these programs. Visiting lecturers could potentially support local faculty in administering modules. Progress in module learning is evaluated by modular exams. Maintaining clear and consistent goals and expectations both in patient care and in the educational curriculum has made it easier for residents to meet those goals. In addition, trainees take annual written and objective structured clinical exams. In 2015, the UR general surgery residents sat the American Board of Surgery In-Training Exam as a more formal and standardized evaluation tool²³.

Additional educational activities such as morbidity and mortality conferences, journal clubs, research meetings and radiology reviews are conducted independently at each teaching site. UR has developed a simulation laboratory, which is used for training exercises by the department of surgery. A basic surgical skills course is held annually for PGY1 residents. In addition, a website was developed with the goal of augmenting the educational program with supplemental resources²⁴. However, this remains a work in progress with the primary challenge being ongoing maintenance and regular updates to the website.

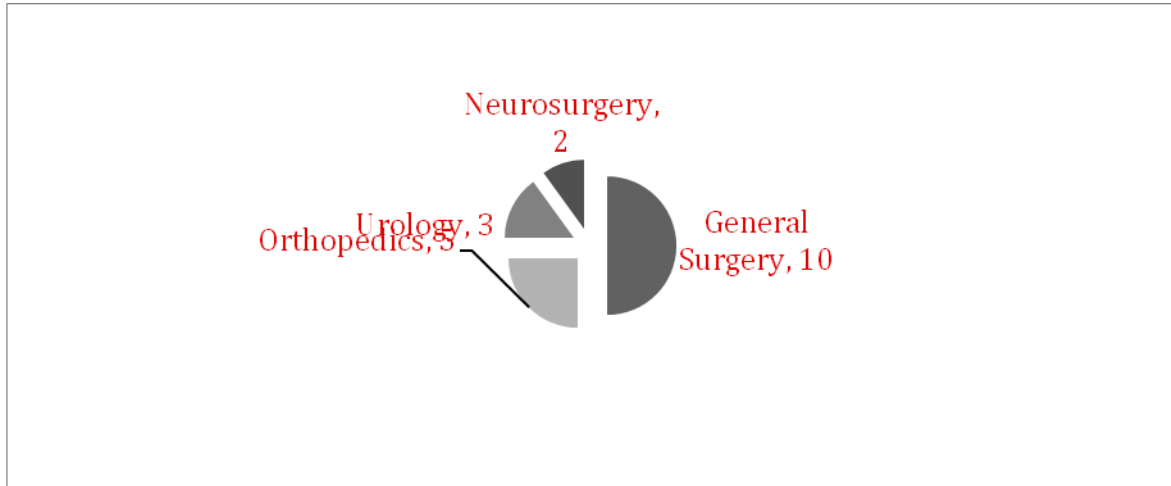


Figure 2. Incoming surgical specialty resident positions available

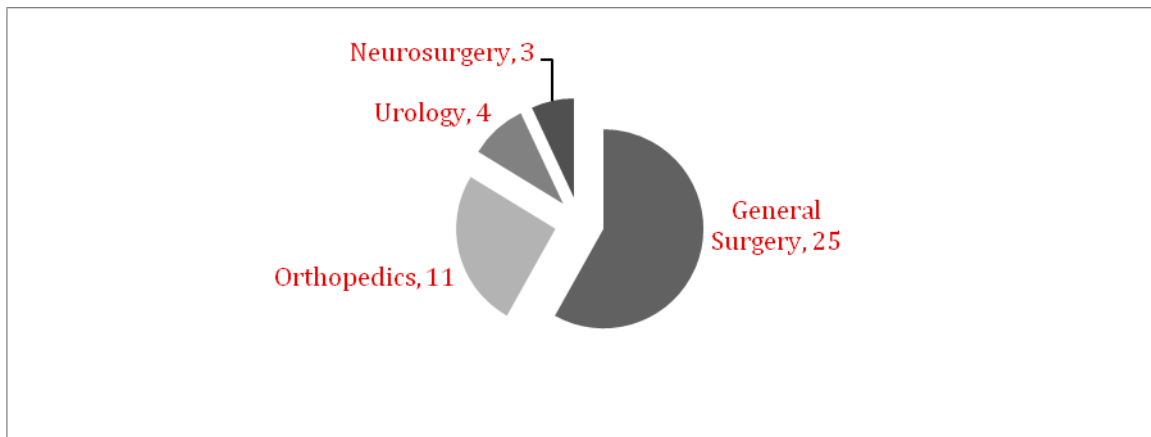
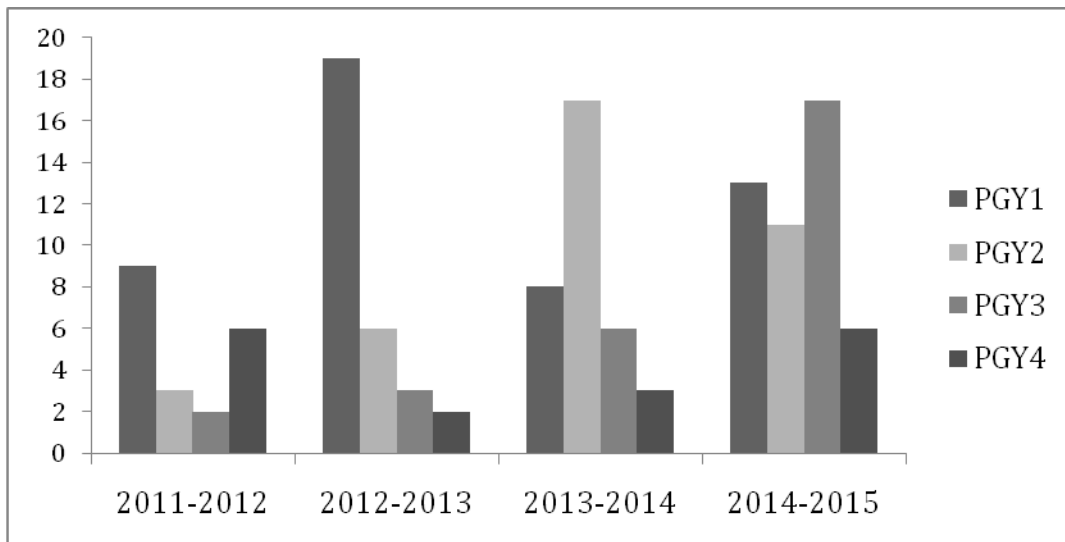


Figure 3. Specialty distribution of surgical residents, academic year 2014 – 2015



PGY = postgraduate year

Figure 4. Expansion of University of Rwanda surgical residency program by year and postgraduate level

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With the increase in the number of residents, there has been greater opportunity for teaching interactions between residents and students. Medical students are assigned to firms and included in the patient care and teaching process. As every firm has a specific curriculum, the clinical teaching is more focused with an increase in the amount of faculty-led bedside teaching. In addition to their responsibilities towards patient care, residents have been given the task of teaching medical students both formally and informally. This allows an increase in educational sessions without overburdening faculty with teaching responsibilities. This form of peer-education is advantageous to the trainees for many reasons²⁵⁻²⁷.

As many surgeons will continue as educators, it is important to teach educational skills early in their career^{25,27}. Also, the instructor learns by preparing for the teaching session²⁶. Finally, students may learn best from those near in age to themselves. Incorporating residents and students into the teaching process facilitates learning while lessening the strain placed on faculty^{25,26}.

Operative Experience

Before

Residents would operate during the daytime with a surgeon, similar to an apprenticeship model. At night, residents would take call, providing care for emergency surgical cases seen in the emergency department. Operative experience was defined by the surgical cases of the mentoring surgeon and the on-call experience.

After

Surgical firms were created to help with patient care and teaching. Operative experience is defined by the firm specialty. Emergency cases comprise a large burden of operative experience and elective cases are often delayed or cancelled due to emergency operations. Similar to other lmics, the operative experience at the public referral hospitals is primarily emergency surgery^{21,22}. This provides a wealth of opportunities to teach emergency care.

However, a well-trained, well-balanced surgeon needs a wide breadth of experience including both elective and emergency care. At the main referral hospital, due to the large volume of emergency cases and relative lack of operating room space, it is difficult finding the time and space to teach elective surgical cases. This is compensated by rotations at other referral hospitals with less emergency surgical volume. However, with the increased number of surgical residents, finding sufficient opportunities for elective operative experience remains a challenge. Other innovative strategies can be employed to increase residents' exposure to elective cases while not compromising access to emergency care. Efforts thus far have focused on increasing the operating theater efficiency and expanding the number of teaching sites. Other mechanisms to increase the breadth of surgical operations could include expansion of simulation laboratory experiences.

As the residency program continues to grow and expand, the HRH Program will need to provide additional specialist faculty to teach these advanced skills. However, additional resources (including operating time and space) will need to be in place to take advantage of these specialists. Another option is to offer rotations in other countries where these specialists are available.

Discussion

There is a great need for surgical care in LMICs and an overall shortage of surgeons. To counteract this, the UR has scaled up surgical training through the assistance of the HRH program. This is a complex process requiring restructuring and organization at many levels. We describe our experiences in this process, including the challenges experienced and lessons learned.

The curricula developed were modeled on the curricula of other surgical training programs^{7, 19}. It is anticipated that UR surgical residents will be qualified to sit the COSECSA membership and fellowship examinations after completion of UR training. Similar to other countries, curriculum development is a complex process¹⁰. Different skills and expertise are needed in different regions and hospitals. Defining a curriculum that adequately trains a surgeon to work in a resource-poor district hospital is different than defining a curriculum for a surgeon who will pursue fellowship training and work at a referral hospital^{3, 4, 10}. While there is a goal to staff all district hospitals with a general surgeon, there also is a need for specialists at the referral hospitals as well as faculty in teaching hospitals.

As the surgical residency program evolves, new challenges will continue to be encountered. The number of residents will steadily increase over the next three years. By the 2017 – 2018 academic year, the number of surgical residents could be as high as 80 postgraduates (more than doubling the current number of residents), while the number of teaching faculty will increase by only 50%. In addition to this, the number of medical students is projected to increase, with the intake of medical students at UR doubling in 2014-2015 academic year. The number of teaching sites in Rwanda will expand to include new referral hospitals, provincial and district hospitals¹⁸. Newly graduated residents will be tasked with both clinical and teaching responsibilities at these new sites. Keeping this in mind, the UR surgical program will need to focus on

efficient mechanisms of teaching, stressing the importance of self-directed study and expanding novel teaching methods such as E-learning and simulation models.

Rwanda has already shown considerable growth in the health sector over the past 20 years¹². As the health system rapidly evolves, it will also be important to anticipate this growth and expansion. While laparoscopy is currently not common in Rwanda, resources are in place to make it more accessible in the referral hospitals. Other subspecialties such as cardiothoracic surgery are likely to evolve at the more specialized referral hospitals.

As the healthcare system evolves, the surgical curriculum will need to evolve with it. Key leaders invested in the Rwandan surgical community will need to evaluate and anticipate changes and guide the residency program to align with the future vision for surgery in Rwanda. Clear programmatic goals should be devised, and systems should be put in place to revise these goals as the needs of the country change. Curricula should be tailored to the local environment. However, they also need to be broad-based and open-minded with the expectation that the healthcare system is rapidly growing and evolving.

Limitations

There are numerous limitations with this study. With the introduction of the HRH program, there have been widespread changes within the healthcare system in Rwanda¹⁸. Each year brings new innovations and challenges. This makes it difficult to measure the impact of any single intervention on outcomes. There are numerous factors impacting the surgical residency program including system changes, the availability and access to new technologies, and social factors^{18, 21}. Due to faculty shortages, it is difficult to implement changes in curricula and exams. Patient care is impacted by variability in access to resources, patient presentation, and accessibility of care at district hospitals. Collecting data to accurately define and measure success is difficult in a low resource setting where there is a minimal resource for patient care, much less for research evaluation. As a result, most of the data is anecdotal and experiential. With increased growth in the health care system, better processes will be developed to monitor such outcomes^{21, 22}.

Conclusion

The UR surgical residency program has been able to increase the quantity of enrolled postgraduates through this innovative program. Partnerships between Imics and hics provide a mechanism to increase surgical training in Imics. Significant changes in resident intake necessitate programmatic changes, stressing the importance of novel methods of teaching with limited teaching faculty. Understanding the ultimate goals of the country can help guide curriculum and program development.

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