

Utilizing the American Board of Surgery In-Training Exam in a Rwandan Surgical Residency program: Alignment of Exam Topics with the University of Rwanda General Surgery Curriculum

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Background: University of Rwanda (UR) increased postgraduate surgery training and assessment strategies are needed. We compared American Board of Surgery In-Training Exam (ABSITE) topics with UR surgery curriculum to determine the applicability of ABSITE in Rwanda.

Methods: Topics are outlined in the Surgical Council on Resident Education (SCORE) curriculum whereas the UR utilizes a modular system. Diseases and conditions in SCORE were compared with UR surgery module content. Operation and procedures in SCORE were compared with operative procedures in UR surgery curriculum.

Results: Overall, 72% of diseases and conditions from SCORE were covered in UR curriculum. Of this, 76% of medical knowledge and 71% of patient care content was covered in UR curriculum. 41% of operations and procedures from SCORE were identified in UR curriculum. 55% of core operations and 16% of advanced operations from SCORE were included in UR general surgery curriculum. Content identified in UR curriculum and not SCORE included infectious and tropical diseases, orthopedics, urology and neurosurgery.

Conclusions: There is alignment between ABSITE topics and UR general surgery curriculum suggesting that the ABSITE can be used as an in-training examination for Rwandan residents. Understanding the limitations of the ABSITE exam can help utilization of this examination.

Key words: internship and residency, curriculum, Rwanda, global health

Introduction

Recognition of surgery as a critical component of public health has contributed to the development and expansion of surgical residency training programs in many low- and middle-income countries (LMICs)¹⁻⁶. With this expansion, there is a need to evaluate residents and training programs to ensure that the educational quality meets standards and improves over time.

The Rwanda Ministry of Health created a novel strategy to counteract a shortage of human resources within Rwanda. The Human Resources for Health (HRH) program was launched in Rwanda in 2012, increasing residency training in internal medicine, pediatrics, obstetrics/gynecology, anesthesia, otorhinolaryngology and surgery, amongst other goals. Through this program, faculty from US institutions work in Rwanda, augmenting the local health education system. This has resulted in an increase in the number of both surgical faculty and trainees¹.

The University of Rwanda (UR) general surgery residency is a four-year training program with a module-based curriculum covering subject matter commonly encountered in a Rwandan clinical setting⁷. Modules are covered in the first three postgraduate years with the fourth postgraduate year focused on development of a research thesis. Residents primarily learn through modules, postgraduate lectures and operative experience. Residents rotate in four different teaching hospitals throughout the country. Performance on annual examinations influences the residents' ability to progress through successive years of training. UR surgical residents take both a written exam and an objective structured clinical exam (OSCE) annually, encompassing all areas of the curriculum. Both written and OSCE examinations are developed by local faculty.

Surgical residents in the United States take the American Board of Surgery In-Training Exam (ABSITE) annually to monitor progress through the surgical curriculum. Similar in-training exams are found in other high-income countries⁸. The ABSITE exam consists of 250 mcqs in a 5-hour block. The ABSITE content is aligned with the Surgical Council on Resident Education (SCORE) curriculum⁹. 72% of the ABSITE exam and SCORE curriculum is patient care topics, 24% medical knowledge and 4% other. 80% of exam questions cover clinical management while 20% covers applied science. The ABSITE is used to help ensure that residents are well prepared to take the American Board of Surgery (ABS) qualifying exam at the completion of surgical training as ABSITE results have been shown to correlate with ABS qualifying exam pass rates¹⁰. We sought to compare ABSITE exam and SCORE curriculum topics with UR general surgery curriculum to determine how applicable the ABSITE could be in a Rwandan context.

Table 1. University of Rwanda general surgery curriculum schedule

	Module	Duration (weeks)
PGY1	Basic sciences	16
	Assessment and management of the surgical patient	6
	Research methodology	4
	Basic surgical skills	4
	Common surgical conditions	18
PGY2	Professional behavior and leadership	4
	Emergency surgery: Non-trauma	16
	Emergency surgery: Trauma	16
	Critical care	12
PGY3	Breast and endocrine	12
	Gastrointestinal	18
	Skin, hernia, plastics	10
	Pediatric surgery	8

PGY = postgraduate year

Material and Methods

The ABSITE exam topics are based on the SCORE curriculum⁹. The SCORE curriculum and ABSITE exam are divided into 13 medical knowledge categories and 28 organ-system based patient care categories^{9, 11}. Within each category is a range of different learning topics. Medical knowledge is categorized by disease and condition and each category is further divided by topic. Patient care is categorized into diseases and

conditions or operations and procedures. These categories are further identified by topic. Patient care categories are also identified by level as either core or advanced. At the core topic level, trainees are expected to have significant knowledge and procedural competency to provide comprehensive care. For advanced topics, trainees are expected to have the knowledge and familiarity sufficient to make a diagnosis and provide initial management⁹.

The UR general surgery curriculum is module-based with broad-based topic coverage over a period of three years (Table 1). UR general surgery curriculum describes both the content and operative procedures that trainees are expected to learn. Most learning is through self-directed learning with some formal lectures, module-based examinations and operative experience.

The SCORE curriculum topics were identified within the UR general surgery postgraduate curriculum. Disease and condition topics in the SCORE curriculum were compared with indicative content from the UR curriculum whereas operation and procedure topics from the SCORE curriculum were compared with practical skills and procedures listed in the UR general surgery curriculum

Comparing SCORE curriculum topics with the UR modular curriculum, most medical knowledge categories are covered in the first postgraduate year whereas patient care categories are covered primarily in the second and third postgraduate years (Table 2).

Overall, 72% of SCORE disease and condition topics were included in the UR general surgery curriculum (Table 3). 76% of medical knowledge topics were included in the UR general surgery curriculum. The greatest correlation of medical knowledge topics was seen in the topics of anesthesia, transfusions and disorders of coagulation and wound healing. 71% of the patient care topics were in the UR general surgery curriculum with 78% of core topics and 59% of advanced topics included in the UR general surgery curriculum. The greatest patient care correlation was seen in the topics of trauma and head and neck. Lower correlation was seen with topics of geriatrics and end of life care, vascular access and transplantation.

A total of 41% of SCORE operation topics were included in the UR general surgery curriculum (Table 4). 55% of core operations were identified in the UR general surgery curriculum and only 16% of advanced operations. The highest correlation was seen in topics of spleen and large intestine. Lower correlation was seen in topics of esophagus, pancreas, transplantation, vascular and nervous system. Topics and procedures identified in the UR general surgery curriculum and not in the SCORE curriculum are noted in Tables 5a and b. Diseases and procedures were primarily infectious and tropical diseases, orthopedic, urologic and neurosurgical conditions.

Table 2. Comparison of American Board of Surgery In-Training Exam and Surgical Council on Resident Education Curriculum categories and University of Rwanda general surgery curriculum⁹

	PGY1				PGY2				PGY3			
	Basic Sciences	Assessment & management of the surgical patient	Research Methodology	Basic Surgical Skills	Common Surgical Conditions	Prof Behavior and Leadership	Emergency surgery: Non-Trauma	Emergency surgery: Trauma	Critical care	Gastrointestinal	Skin, hernia, plastics	Pediatric surgery
Abdomen												
General					X		X			X		
Hernia					X		X			X	X	
Biliary					X		X			X		
Liver					X		X			X		
Pancreas					X		X			X		
Spleen					X		X			X		
Alimentary Tract												
Esophagus					X		X			X		
Stomach					X		X			X		
Small intestine					X		X			X		
Large intestine					X		X					
Anorectal					X		X					
Endoscopy												
Breast					X							
Endocrine					X							
Skin & soft tissue					X		X	X			X	
Surgical critical care								X	X			
Trauma												
								X				
Vascular												
Arterial disease					X		X	X				
Venous disease					X		X					
Access					X		X					
Transplantation												
									X			
Thoracic surgery												
							X	X				
Pediatric surgery												
					X		X	X				X
Plastic surgery												
											X	
Genitourinary												
					X		X	X				
Gynecology												
					X		X	X				
Head & neck												
					X			X				
Nervous system												
							X	X				
Anesthesia												
		X		X					X			
Biostatistics & evaluation of evidence												
			X			X						
Fluids, electrolytes & acid-base balance												
	X	X							X			
Geriatric surgery & end-of-life care												
Immunology												
	X											
Infection & antimicrobial therapy												
	X	X							X			
Minimally invasive surgery												
										X		
Nutrition & metabolism												
	X	X							X			
Oncology & tumor biology												
	X											
Pharmacology												
	X											
Preoperative evaluation												
		X										
Transfusion & disorders of coagulation												
	X	X							X			
Wound healing												
	X											

PGY = postgraduate year

Table 3. Disease and conditions: Correlation of American Board of Surgery In-Training Exam and Surgical Council on Resident Education Curriculum with University of Rwanda general surgery curriculum⁹

	ABSITE Topics N			UR Topic correlates N/N (%)		
	Core	Advanced	Total	Core	Advanced	Total
Patient Care						
Abdomen						
General	3	7	10	2/3 (67%)	2/7 (29%)	4/10 (40%)
Hernia	5	0	5	4/5 (80%)	NA	4/5 (80%)
Biliary	8	6	14	7/8 (88%)	2/6 (33%)	9/14 (64%)
Liver	2	6	8	2/2 (100%)	5/6 (83%)	7/8 (88%)
Pancreas	2	8	10	1/2 (50%)	7/8 (88%)	8/10 (80%)
Spleen	1	4	5	0/1 (0%)	1/4 (25%)	1/5 (20%)
Alimentary Tract						
Esophagus	9	4	13	14	4/4 (100%)	11/13 (85%)
Stomach	5	4	9	8	1/4 (25%)	6/9 (67%)
Small intestine	12	2	14	9/12 (75%)	1/2 (50%)	10/14 (71%)
Large intestine	12	3	15	10/12 (83%)	3/3 (100%)	13/15 (87%)
Anorectal	6	3	9	5/6 (83%)	3/3 (100%)	8/9 (89%)
Endoscopy	0	0	0	NA	NA	NA
Breast	22	2	24	13/22 (59%)	0/2 (0%)	13/24 (54%)
Endocrine	11	3	14	10/11 (91%)	3/3 (100%)	13/14 (93%)
Skin and soft tissue	10	4	14	8/10 (80%)	2/4 (50%)	10/14 (71%)
Surgical critical care	18	0	18	12/18 (67%)	NA	12/18 (67%)
Trauma	31	10	41	29/31 (94%)	10/10 (100%)	39/41 (95%)
Vascular						
Arterial	9	10	19	7/9 (78%)	4/10 (40%)	11/19 (58%)
Venous	4	0	4	2/4 (50%)	NA	2/4 (50%)
Access	2	0	2	0/2 (0%)	NA	0/2 (0%)
Transplant	1	5	6	1/1 (100%)	0/5 (0%)	1/6 (17%)
Thoracic surgery	2	8	10	2/2 (100%)	2/8 (25%)	4/10 (40%)
Pediatric surgery	10	13	23	7/10 (70%)	10/13 (77%)	17/23 (74%)
Plastic surgery	1	0	1	0/1 (0%)	NA	0/1 (0%)
Genitourinary	1	3	4	1/1 (100%)	2/3 (67%)	3/4 (75%)
Gynecology	3	3	6	3/3 (100%)	2/3 (67%)	5/6 (83%)
Head and neck	2	2	4	2/2 (100%)	2/2 (100%)	4/4 (100%)
Nervous system	1	1	2	1/1 (100%)	0/1 (0%)	1/2 (50%)
Patient Care Total	193	111	304	150/193 (78%)	66/111 (59%)	216/304 (71%)
Medical Knowledge						
Anesthesia			6			6/6 (100%)
Biostatistics and evaluation of evidence			8			7/8 (88%)
Fluids, electrolytes and acid-base balance			6			5/6 (83%)
Geriatric surgery and end-of-life care			7			0/7 (0%)
Immunology			4			3/4 (75%)
Infection and antimicrobial therapy			12			10/12 (83%)
Minimally invasive principles			4			3/4 (75%)
Nutrition and metabolism			7			5/7 (71%)
Oncology and tumor biology			7			6/7 (86%)
Pharmacology			2			1/2 (50%)
Preoperative eval. and perioperative care			8			6/8 (75%)
Transfusions and disorders of coagulation			4			4/4 (100%)
Wound healing			5			5/5 (100%)
Medical Knowledge Total			80			61/80 (76%)

Table 4. Operations and procedures: Correlation of American Board of Surgery In-Training Exam And Surgical Council on Resident Education Curriculum with University of Rwanda general surgery curriculum⁹.

	ABSITE Topics N			UR Topic correlates N/N (%)		
	Core	Advanced	Total	Core	Advanced	Total
Abdomen						
General	4	1	5	4/4 (100%)	0/1 (0%)	4/5 (80%)
Hernia	4	1	5	3/4 (75%)	0/1 (0%)	3/5 (60%)
Biliary	5	7	12	4/5 (80%)	0/7 (0%)	4/12 (30%)
Liver	2	4	6	2/2 (100%)	0/4 (0%)	2/6 (33%)
Pancreas	3	6	9	0/3 (0%)	0/6 (0%)	0/9 (0%)
Spleen	2	0	2	2/2 (100%)	NA	2/2 (100%)
Alimentary Tract						
Esophagus	5	2	7	0/5 (0%)	0/2 (0%)	0/7 (0%)
Stomach	4	2	6	3/4 (75%)	0/2 (0%)	3/6 (50%)
Small intestine	6	1	7	5/6 (83%)	0/1 (0%)	5/7 (71%)
Large intestine	5	1	6	5/5 (100%)	1/1 (100%)	6/6 (100%)
Anorectal	7	5	12	4/7 (57%)	2/5 (40%)	6/12 (50%)
Endoscopy	6	0	6	2/6 (30%)	NA	2/6 (30%)
Breast	6	1	7	5/6 (83%)	0/1 (0%)	5/7 (71%)
Endocrine	3	1	4	1/3 (33%)	1/1 (100%)	2/4 (50%)
Skin and Soft tissue	5	2	7	3/5 (60%)	1/2 (50%)	4/7 (57%)
Surgical critical care	15	2	17	7/15 (47%)	0/2 (0%)	7/17 (41%)
Trauma	21	3	24	10/21 (48%)	2/3 (67%)	12/24 (50%)
Vascular						
Arterial	7	11	18	2/7 (29%)	0/11 (0%)	2/18 (11%)
Venous	3	0	3	0/3 (0%)	NA	0/3 (0%)
Access	3	0	3	1/3 (33%)	NA	1/3 (33%)
Transplant	0	6	6	NA	1/6 (17%)	1/6 (17%)
Thoracic surgery	4	2	6	2/4 (50%)	1/2 (50%)	3/6 (50%)
Pediatric surgery	6	14	20	5/6 (83%)	1/14 (7%)	6/20 (30%)
Plastic surgery	2	0	2	2/2 (100%)	NA	2/2 (100%)
Genitourinary	5	0	5	2/5 (40%)	NA	2/5 (40%)
Gynecology	2	1	3	1/2 (50%)	1/1 (100%)	2/3 (67%)
Head and neck	3	2	5	2/3 (67%)	1/2 (50%)	3/5 (60%)
Nervous system	2	1	3	0/2 (0%)	0/1 (0%)	0/3 (0%)
Total	140	76	216	77/140 (55%)	12/76 (16%)	89/216 (41%)

Table 5a. Content in University of Rwanda general surgery curriculum not identified in American Board of Surgery In-Training Exam and Surgical Council on Resident Education Curriculum

Disease/condition
Basic sciences
Filariasis
Sickle cell
Leishmaniasis
Common surgical conditions
Typhoid, amebiasis, schistosomiasis, hydatid disease, ascaris infestation
Tuberculosis of the gastrointestinal tract
Genitourinary tuberculosis
Spinal nerve root entrapment and spinal cord compression
Metastatic bone cancer
Contractures including burns, polio, Dupuytren's
Club foot
Congenital dislocation of the hip, Perthe's disease
Metabolic, endocrine and degenerative disorders of bones
Principles of internal fixation of fractures, osteotomy, bone grafting
Hand deformities – congenital and acquired
Surgical complications of leprosy
Mycetoma, phycomycoses
Spinal tuberculosis
Tumors of the central nervous system
Principles of craniectomy
Nerve entrapment syndromes
Basic surgical skills
Tourniquet use including indication, effects and complications
Emergency surgery: Non-trauma
Pyomyositis
Tuberculous disease of the chest and abdomen
Acute septic arthritis
Intracranial sepsis
Emergency surgery: Trauma
Animal injuries

Table 5b: Content in University of Rwanda general surgery curriculum not identified in American Board of Surgery In-Training Exam and Surgical Council on Resident Education Curriculum

Operation/procedure
Common surgical conditions
Vasectomy
Circumcision
Insertion of Steinman pin
Manipulation of fractures
Application of plaster of Paris
Application of external fixator
Lower segment caesarian section
Salpingectomy
Dental extraction
Tarsorrhaphy
Rib resection
Critical care
Lumbar puncture
Intercostal and brachial nerve blocks
Insertion of peritoneal dialysis catheter
Primary vascular access for hemodialysis
Emergency surgery: Non-trauma
Exploration of scrotum
Reduction of paraphimosis
Burr hole and craniotomy for intracranial abscess
Episiotomy
Caesarian section
Surgery for ruptured ectopic pregnancy
Emergency surgery: Trauma
Manipulation and plaster of Paris splinting of fractures
Skin and skeletal traction
Open fracture debridement and external fixation
Insertion of Steinman pin
Nerve repair
Surgical approaches to joints and arthrotomy
Emergency management of spinal injury
Emergency management of closed and open head injury
Burr holes and craniotomy
Breast and endocrine
Retrosternal goiter
Thyroglossal cystectomy
Submandibular gland excision
Pediatric surgery
Orchidopexy
Circumcision

Discussion

One concern with utilizing an exam such as the ABSITE in Rwanda is the relevance of the content material to a low-resource setting. There are many factors that influence the differences in clinical experience between hics and lmics including disease epidemiology, clinical resources, patient access and affordability. The UR general surgery curriculum was developed to train surgeons to work primarily at local district hospitals addressing local disease conditions. This study shows that 70% of ABSITE exam topics are found within the UR general surgery curriculum and many topics found in the UR curriculum were not identified in the SCORE curriculum. The SCORE curriculum was previously used as a guide to help design a contextually appropriate curriculum in Botswana, with similar appreciation of differences in clinical experience⁶.

Medical knowledge is common and relevant to surgeons worldwide and 76% of SCORE medical knowledge topics were identified in the UR general surgery curriculum. However, UR residents may find the topic coverage more challenging due to resource limitations. Some basic laboratory studies are not routinely available in Rwanda. For example, UR residents learn about acid-base disorders, but do not have consistent supply of material resources, such as laboratory tests, to apply these principles in the clinical scenario.

The patient care portion of the exam is geared toward clinical scenarios commonly encountered by US general surgery residents. While 71% of the patient care disease and conditions were covered in the UR general surgery curriculum, the clinical management may vary. There are differences in disease processes, patient presentation, laboratory and radiographic availability and management options available between the different countries⁷. For example, Hirschprung's disease and imperforate anus are commonly seen in Rwanda. The majority of management is focused on immediate stabilization of the patient with a diverting colostomy while definitive operations are often reserved for times when a visiting pediatric surgeon is available. Efforts are underway to increase the experience of local surgeons in sub-specialties such as pediatrics and oncoplastic surgery.

The operative knowledge varies substantially between the SCORE and UR curricula. Only 41% of operations from the SCORE curriculum were identified in the UR general surgery curriculum. Rwandan surgical residents are expected to learn a much wider breadth of operations compared with US surgical residents including orthopedics, urologic and neurosurgical procedures. Operations commonly performed in LMICs are predominantly emergency general surgery and orthopedic procedures^{6,7,12,13}. The majority (60%) of procedures performed at a major referral hospital in Rwanda were emergency operations^{7, 12}. In contrast, US surgical residents are expected to be familiar with more complex general surgery cases such as transplantation or esophagectomy. While UR residents will be familiar with the basics of such operations, they do not get routine exposure to complex operations.

As the nature of surgery in Rwanda is rapidly evolving, the exposure of UR residents to complex operations will change over the ensuing years and these advanced topics will become more relevant. More advanced technologies will become available and more surgical specialists will be working in Rwanda. Strategies are currently being implemented to increase UR surgical resident exposure to elective operations through rotations at new sites and surgical outreach programs.

Injury and trauma are one of the most prevalent diseases in lmics and UR residents encounter extremity injuries on a daily basis. UR residents develop skills in fracture management, stabilization and fixation. In contrast, extremity fracture and traumatic amputation is considered an advanced topic in the SCORE curriculum⁹.

The UR surgical curriculum is module based and designed towards diseases and procedures relevant for practitioners in the local context. Each module is directed by a faculty leader who organizes a team to teach and evaluate through various learning modalities such as lectures, interactive sessions, or practice tests. The modular system was fully implemented in Rwanda in the 2014-2015 academic year. In the past the training was mainly service based with some selected topics for postgraduate lectures.

Several studies have described methods that resulted in improved US resident ABSITE scores ranging from having a dedicated educational chief resident, organized curriculum with assigned readings, regular quizzes and working through practice multiple choice questions¹⁴⁻¹⁸. The UR surgical department is working to implement similar strategies. In the past, lectures were administered across all trainees but future efforts are focused on targeting lectures towards trainee level. In addition, modules are being reorganized with greater faculty oversight and progressive assessments.

With the increase in trainees has come the added challenge of improving the monitoring and evaluation process for trainees. The challenge inherent in implementing changes such as these comes with the shortage of faculty. There is insufficient faculty within the department to supervise lectures, organize and administer modules or write examination questions. Through the HRH program, there has been an increase in surgical faculty to help develop and administer examinations. Graduates of the training program will remain in teaching institutions to continue educating future generations. New strategies are being developed to support teaching staff.

Currently, UR residents are evaluated through written and OSCE exams created by local staff annually. There is no system in place to standardize examinations from year to year. The ABSITE provides the opportunity for UR surgical residents to take a more standardized and consistent exam each year. The online nature of the exam allows it to be administered in Rwanda, with minimal technical and logistical challenges. However, no study to date has shown that utilizing the ABSITE results in better training, technical skills, patient management or outcomes. The results of the ABSITE can provide feedback for Rwandan educators regarding resident learning and teaching efficacy of specific topics. The results from the ABSITE are not used to evaluate the trainees themselves.

There are other examination opportunities in sub-Saharan Africa such as the College of Surgeons of East, Central and Southern Africa (COSECSA) Membership Examination^{19, 20}. One must be a registered COSECSA trainee for a minimum of 2 years prior to sitting the exam. As such, postgraduate 1 and 2 year residents would not be eligible for the exam. In addition, trainees must maintain a relevant logbook and follow through with specific case studies. Costs for the COSECSA exam are \$250 per year. The COSECSA exam allows the trainee to qualify for membership in COSECSA. However, it is not designed as a training exam to take on an annual basis to monitor resident progress. Overall, the costs and logistics associated with this program make it difficult to administer to all surgical residents on an annual basis.

Residents are still encouraged to register with COSECSA to allow them the benefit from additional training opportunities that are not available through UR such as the School for Surgeons²¹. Comparison between the SCORE curriculum and School for Surgeons did not find significant differences between the two platforms although one was designed for US surgical postgraduates and the other for sub-Saharan African surgical providers²².

In the future, a trainee exam geared toward topics relevant to sub-Saharan Africa or other LMICs would be beneficial as there are surgical postgraduate training programs in other LMICs that also administer annual exams^{3,23-27}. An organization such as COSECSA could develop an annual trainee exam at a reduced rate that could be administered to multiple different training

programs throughout the region. Examination questions could be tailored to common disease processes and operations relevant to sub-Saharan Africa. Resources would need to be developed to maintain a secure and sustainable bank of questions with the capacity to administer the exam to many trainees over a wide geographic area while maintaining exam integrity.

Conclusion

The ABSITE examination can be utilized as an evaluation strategy for Rwandan surgical trainees. While the examination content may not mirror that of the UR general surgery curriculum the test provides a useful mechanism to help guide surgical educators in this setting. Utilizing this test, the UR surgical curriculum and teaching can be further strengthened to improve resident performance on future exams, focusing on topic areas that are relevant to Rwandan clinicians.

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