

Designing a Contextually Appropriate Surgical Training Program in Low-resource Settings: The Botswana Experience

Dorotea Mutabdzic · Alemayehu G. Bedada ·
Balisi Bakanisi · Joseph Motsumi · Georges Azzie

Published online: 1 August 2012
© Société Internationale de Chirurgie 2012

Abstract

Background The global burden of surgical disease and severe shortage of trained surgeons around the world are now widely recognized. The greatest challenge in improving access to surgical care lies in sub-Saharan Africa, where the number of surgeons per population is lowest. One part of the solution may be to create programs to train surgeons locally. We present our experience with an approach to designing a contextually appropriate surgical curriculum in Botswana.

Methods Surgical logbooks from the largest tertiary care center in Botswana, dating from 2004 through 2010, were analyzed to yield total case numbers within clearly defined categories. Case numbers and local surgical opinion were combined to design a contextually relevant curriculum, with the Surgical Council on Resident Education curriculum as a template.

Results Logbook analysis revealed that general surgeons in Botswana manage burns and perform a large number of

skin grafts and extremity amputations. However, they perform few colonoscopies and complex laparoscopic procedures. The new curriculum included greater emphasis on surgical subspecialty procedures and surgical management of locally relevant conditions, such as the complications of infectious diseases. Less emphasis was placed on management of uncommon conditions such as inflammatory bowel disease.

Conclusions There are important differences in the scope of general surgery and the knowledge and skills required by general surgeons in Botswana compared with their North American counterparts. We present a simple and inexpensive approach that could serve as a potential model for designing contextually relevant surgical training programs in other low-resource settings.

Introduction

The worldwide burden of surgical disease and severe shortage of trained surgeons are widely recognized. The lack of access to surgical care is most important in sub-Saharan Africa, where the number of surgeons per population is lowest [1]. One part of the solution may be to create programs to train surgeons locally. The hope is that this would prevent the brain drain that occurs when specialists are trained abroad and never return to their native countries [2]. Current efforts have focused either on the creation of academic training programs or the development of task-shifting projects. The latter are designed to train medical officers or non-medical personnel, in a timely fashion, to perform a number of specific procedures, such as Cesarean sections [3–6].

In recent times, new surgical training programs in low income and middle income countries have commonly been

D. Mutabdzic (✉) · B. Bakanisi · G. Azzie
Faculty of Medicine, General Surgery Residency Program
Office, St. Michael's Hospital, University of Toronto, QW 3071,
30 Bond Street, Toronto, ON M5B 1W8, Canada
e-mail: dorotea.mutabdzic@gmail.com

A. G. Bedada · B. Bakanisi · J. Motsumi
Princess Marina Hospital, P.O. Box 258, Gaborone, Botswana

B. Bakanisi · J. Motsumi · G. Azzie
Faculty of Medicine, University of Botswana, Gaborone,
Botswana

G. Azzie
Division of General Surgery, The Hospital for Sick Children,
Room 1505, Roy C Hill Wing, 555 University Avenue, Toronto,
ON M5G 1X8, Canada

developed in partnership with, or under the guidance of, an international partner academic institution or surgical governing body. It is important to note, however, that in many low income and middle income countries local efforts began long before these partnerships were established [7]. Some examples of partnerships include a new postgraduate surgical training program in Eritrea that was developed in partnership with the George Washington University Medical Center [8]. Similarly, a new surgical training program was developed in Guyana in partnership with the Canadian Association of General Surgeons [9]. In Papua New Guinea, a training program was developed with support from the Royal Australasian College of Surgeons [10]. More recently, the Pan-African Academy of Christian Surgeons has developed a rural-based surgical training program in collaboration with the Loma Linda University in California and the College of Surgeons of East, Central, and Southern Africa (COSECSA) [11]. COSECSA itself, has partnered with the Royal College of Surgeons of Edinburgh. The nature of these partnerships varies widely. Some partners provide personnel in the form of surgeon educators. Others assist with infrastructure and provide on-line streaming of lectures and academic programs. Still others provide funding for full or partial training in the partner country. In general, the programs emulate the model of the partner institution. Contextualization to the environment of the low income or middle income country partner varies.

Historically, these partnered training programs have been individualized efforts without global discussion on how best to approach the design and implementation of a surgical training program in low-resource settings. There has been even less discussion of the nature of these partnerships and their inherent ethical issues. COSECSA has recently made progress in unifying surgical training efforts by creating an examining body and common curriculum. However, the high-income country partnerships still exist and remain influential in the individual training programs. Although each location presents its own unique challenges, there is some common ground to be tread by all. Open discussion of experiences in addressing the challenges in low-resource settings could facilitate the process for future training endeavors. We present our approach to designing a contextually appropriate surgical training program in Botswana as a potential model for the design of relevant surgical training programs in low-resource settings.

Botswana is a country in sub-Saharan Africa, sharing borders with Zambia, Zimbabwe, South Africa, and Namibia. The population of Botswana is approximately 1.95 million [12]. In 2011, there were 27 consultant or specialist surgeons registered with the Botswana Health Professions Council. Of these, three are Botswana who trained overseas and 24 are expatriate surgeons who may not be in country all

year. In addition, there are licensed doctors who do not have fully recognized surgical training, performing emergency procedures, especially in rural areas.

The University of Botswana inaugurated its medical school in 2009. Students are currently in the pre-clinical phase. In addition, residency programs in internal medicine, pediatrics, anesthesia, public health, and family medicine were started in 2010. Until the new University Hospital is completed, most of the training is taking place at the largest tertiary care center in the country, Princess Marina Hospital in the capital city, Gaborone. Princess Marina Hospital is a publicly funded, Ministry of Health hospital. Inpatient care, outpatient care, and in-hospital pharmaceuticals are provided free of charge. The family medicine program is taking place at peripheral publically funded centers. There are plans for a general surgery training program, although vital faculty positions in the Department of Surgery at the University of Botswana remain to be filled. Dr. Georges Azzie, a pediatric general surgeon at the Hospital for Sick Children in Toronto, Canada, has also been affiliated with the Ministry of Health in Botswana since 2005 and the University of Botswana School of Medicine since 2007. He was asked to assist with current surgical training of medical officers and to advise on how to start a formal surgical residency program in Botswana.

After reviewing the literature, we recognized that there was no prescribed approach to developing a surgical training program and that we would need to develop our own. We thought it would be wise to start by analyzing the types and the numbers of procedures being performed by general surgeons in Botswana. Once we had an idea of what the end-product general surgeon should be capable of, we could begin to think about designing a curriculum that was appropriate in the context of Botswana.

We started by analyzing surgical logbooks in order to characterize the local surgical repertoire. Combining the results of the logbook analysis with local surgical opinion, and using the Surgical Council on Resident Education (SCORE) curriculum outline as a template, we designed a contextually appropriate curriculum. Figure 1 outlines our approach, which could serve as a potential model for designing a contextually relevant surgical curriculum in other low-resource settings.

Methods

Analysis of surgical logbooks

Approval for logbook data analysis was obtained from the Institutional Review Boards affiliated with Princess Marina Hospital and the Ministry of Health in Botswana. Surgical

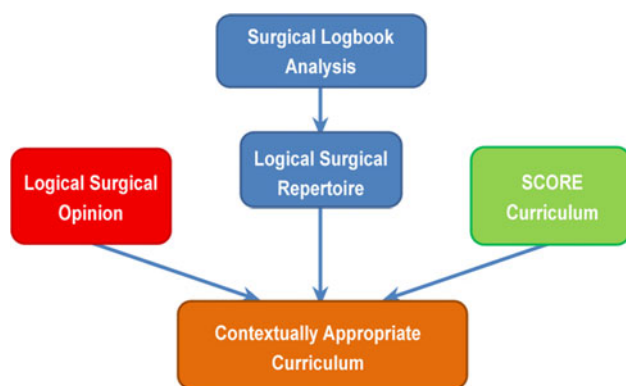


Fig. 1 Model for designing a contextually appropriate surgical training curriculum in low-resource settings

logbook data collected at Princess Marina Hospital from 2004 to 2010 were entered into an Excel spreadsheet. Procedures were coded into the American Medical Association Current Procedural Terminology (CPT) codes. These codes were further aggregated into the Accreditation Council for Graduate Medical Education (ACGME) Defined Categories. Total case number per year within each category was calculated.

Surgical Council on Resident Education (SCORE) curriculum outline

The SCORE curriculum [13] is divided into 28 organ system-based ACGME defined categories. Within each category are listed “diseases/conditions” and “operations/procedures.” Diseases/conditions are further subclassified

into “broad” and “focused.” “Broad” implies that a graduate should be able to care for all aspects of disease and provide comprehensive management. “Focused” implies that a graduate should be able to make the diagnosis and provide initial management/stabilization but is not expected to provide comprehensive management. For sake of clarity, we changed the nomenclature from “broad” to “mastery of” and from “focused” to “knowledge of.” According to the SCORE curriculum, the operations/procedures are further subclassified into “essential-common,” “essential-uncommon,” and “complex.” “Essential-common” procedures are frequently performed in general surgery; “essential-uncommon” procedures are rare, often urgent procedures performed in general surgery practice but not typically done in significant numbers by trainees; and “complex” procedures are not typically performed in a general surgery practice and are more commonly performed by subspecialists.

Curriculum design

Using the SCORE curriculum as a template, we combined the results of the logbook analysis with modifications based on local surgical opinion to design a curriculum that is appropriate for the local context.

Results

Table 1 displays the total case number per year within each Defined Category at Princess Marina Hospital (PMH) from

Table 1 Total number of cases per year within each defined category at Princess Marina Hospital from 2004–2010, with ACGME minimum requirements for each category included for reference

Defined category	2010	2009	2008	2007	2006	2005	2004	ACGME minimum
Liver	7	10	5	7	5	6	5	4
Pancreas	5	4	2	3	2	7	6	3
Abdomen—general	186	185	204	199	257	224	183	65
Alimentary tract	290	296	318	317	317	220	157	72
Endocrine	16	27	21	15	17	17	19	8
Endoscopy—upper	34	40	50	53	23	80	20	35
Endoscopy—colonoscopy	0	0	0	0	0	0	13	50
Head & neck	7	5	9	24	22	19	21	24
Laparoscopic—basic	44	47	29	40	23	2	17	60
Laparoscopic—complex	0	0	0	0	0	0	0	25
Plastic	117	120	144	194	191	139	148	5
Skin, soft tissue, and breast	145	204	217	278	310	315	322	25
Thoracic	15	30	29	35	9	13	13	15
Trauma—operative	77	54	73	76	70	63	31	10
Vascular	88	55	74	53	80	57	47	44
All major	1,020	1,078	1,175	1,296	1,313	1,169	1,011	750

2004 to 2010. The ACGME Defined Category minimum case numbers are included for reference. These numbers represent the minimum number of cases a general surgery resident in the United States must have logged as primary surgeon within each category before graduation. The minimums were initially set by taking the number of cases representing the tenth percentile from an analysis of graduates' case logs. They are presented with our data, keeping in mind that PMH is meant to be the primary training site for the new training program. By looking at the minimums required per trainee as per ACGME, we could make an estimate as to how many trainees could participate in the program at PMH and what their expected operative experience would be. At Princess Marina, there are relatively few cases in some categories, such as liver, pancreas, endoscopy-colonoscopy, head and neck, laparoscopic-basic, laparoscopic-complex, and thoracic. However, Table 1 also shows some categories in which the number of cases in Botswana far exceeds the ACGME minimum: for example, plastic surgery. Of the hundreds of plastic surgery cases performed by general surgeons in Botswana, approximately 60 % were skin grafts, and most are related to burns. In addition, it is interesting to note that the total number of vascular surgery cases was 40–90 per year, but that approximately 80 % were amputations.

Several significant changes to the original SCORE template were made in order to contextualize the training program in Botswana. For instance, “mastery of” surgical management of infectious diseases is expected in Botswana. Similarly, “mastery of” the management of burns is expected. Certain procedures, such as skin grafts and amputations, were upgraded to “essential-common” while laparoscopic procedures were classified as “essential-uncommon.”

Discussion

Our colleagues at the University of Botswana, School of Medicine continue to be very eager to start a general surgery training program. However, having already experienced many challenges with the other inaugural postgraduate programs, they want to approach a surgical program in as thoughtful and measured a way as possible. The need remains great, with only 27 surgeons (including all surgical specialties) for a population of 1.95 million (1:72,000). Although a surgical training program can only hope to produce a handful of surgeons per year, it is an important component of a strategy to increase access to surgical care.

The design of a contextualized program in Botswana involved the combination of three major elements. The first was the analysis of surgical logbook data, which served as a needs assessment. It characterized the types of procedures a

trainee would need to master, and it allowed contextualization of training in order to meet the needs. The second element was selection of a simple and widely applicable framework on which to build a curriculum. The third element was local expert opinion. Combining these three elements ultimately yielded a contextualized curriculum. Although we describe the elements in sequence, much of the development took place in parallel.

The first element was the analysis of the surgical logbooks. The results led to some interesting revelations into the breadth and scope of a general surgical practice in Botswana. For example, there are no plastic surgeons or burn centers in Botswana. Therefore, general surgeons manage burns and perform a large number of skin grafts. Similarly, general surgeons in Botswana must be competent in performing amputations, a procedure that would be in the scope of sub-specialist vascular or orthopedic surgeons in most North American centers. The results suggest that most traditional general surgery training programs would need to provide supplemental training in relevant subspecialties in order to fully prepare trainees for surgical practice in Botswana. Furthermore, there were relatively few cases performed at Princess Marina in some categories, which suggests that it may be difficult for trainees in Botswana to gain enough local exposure during their training to achieve competency in these areas.

The second element involved selection of a framework on which to base the curriculum. After reviewing the literature on the development of surgical training programs, we found a growing emphasis on competency-based education. With regard to surgical knowledge and skill, this was manifested by increasing attention to the number of cases required for trainees to achieve competency. Of the training models described, only the American model had clear minimum case number requirements for surgical trainees. American general surgery trainees must log a total of 750 cases, but also must meet more specific requirements within clearly defined categories. For example, trainees are required to log 4 liver cases, 50 colonoscopies, and 72 alimentary tract cases. A logged case must be one in which the trainee was the primary surgeon in addition to being involved in the patient's preoperative and postoperative care.

We felt that an objective measurement of surgical experience would be a vital component of a competency-based training program. When faced with the challenge of quantifying the numbers and types of cases that were being done in Botswana, the ACGME classification system seemed simple and clear. Because our logbook analysis made use of the same defined categories as the SCORE curriculum outline, it followed that our results and curriculum template were easily compatible. In addition, the University of Botswana and Princess Marina Hospital have long-standing

relationships with American partners, including the Baylor College of Medicine, Harvard University, and the University of Pennsylvania. In view of these pre-existing partnerships, the clarity and simplicity of the framework, and the direct compatibility of our logbook analysis results, we elected to use the American model as the framework for the design of a contextually relevant curriculum.

The third element involved further contextualization using local expert opinion. We combined the results of logbook analysis with the outline of the SCORE curriculum and then engaged local experts to discuss where modifications needed to be made in order to reflect the local needs. The results highlighted important differences in knowledge and skill that are required of surgeons in Botswana compared with their counterparts in the United States. For example, surgical management of infectious diseases was not included in the SCORE template, and was an important addition to the Botswana curriculum. In contrast, inflammatory bowel disease is rarely seen in Botswana and should be considered a condition that a general surgeon in Botswana needs to have knowledge of rather than mastery of. Greater emphasis was placed on common subspecialty procedures that are performed by general surgeons in Botswana, such that trainees would be expected to be proficient in performing skin grafts and amputations. Laparoscopic procedures were considered essential but are presently uncommonly performed. We expect the surgical training curriculum in Botswana to evolve over time, especially as we continue efforts to make laparoscopic procedures more common.

There are some important limitations to our approach to the design of a contextualized surgical curriculum. The first is that we used surgical logbook data alone as a correlate of the burden of surgical disease. We did not have other sources, such as clinic or casualty data. This implies that our measured burden of disease is more aptly described as operative, not surgical. Also, our analysis included data from only one hospital, albeit the largest in the country. It also represents the part of the population that relies on the publicly funded hospital, as opposed to the parallel private system. Although the proposed surgical training program will take place at this same hospital, at least for the time-being, the proportion and type of cases might be significantly different from the types of cases performed in smaller centers. Limitations specific to our analysis of logbook data were also significant. For instance, sometimes the procedure recorded was vague; it may have been recorded as an “exploratory laparotomy for intestinal obstruction.” Because significant operative details were lacking, our totals may be underestimating certain procedures (bowel resections, creation of stomas, etc.). Furthermore, pediatric surgery and nonoperative trauma data were not included in our analysis. Pediatric surgery data

were only available from 2008. Nonoperative trauma cases are currently not recorded in a logbook, and management of these cases is shared with the accident and emergency department.

Our sense is that the simplicity and flexibility afforded by this contextualized SCORE curriculum will allow ongoing modification and refinement. As more data and further metrics (such as outpatient data or epidemiological studies of burden of surgical disease) emerge, the curriculum will be modified. New procedures may be added, the classification ascribed to a given procedure may be modified, and the minimum case numbers required for a given procedure may be increased or decreased.

Our next steps will include development of an academic program. After presenting our work at two international meetings, we have received very useful feedback. Residents from other training programs pointed out that high income country partners are often asked to contribute time to teach as part of an academic program. The residents expressed their frustration at the often disorganized nature of these lectures, the irrelevance of the topics taught, and the sometimes inappropriate level of training of the teachers, such as when a junior resident is teaching more senior colleagues.

As previously mentioned, although we selected the SCORE template to design our curriculum, the approach is a flexible one, and we are able to incorporate elements from other models. For example, the Royal College of Surgeons of Ireland and the College of Surgeons of East, Central, and Southern Africa (COSECSA) have broken considerable ground in establishing surgical training programs in several African countries. The framework described in this article could easily be filled with material from, and be maintained by, any group or organization. The ultimate goal is local ownership. Local surgeons, administrators, and trainees will decide how to build on what has been done so far.

Although future goals have been identified, there are many challenges that lie ahead, particularly with the implementation of a new surgical training program in Botswana. Important faculty positions in the Department of Surgery have not yet been filled. As mentioned previously, the new University of Botswana hospital is not yet completely built, so the program would have to temporarily be housed at Princess Marina Hospital. The staff at PMH are employed by the Ministry of Health and do not have faculty affiliations with the University of Botswana. Their roles and responsibilities as teachers have not been clearly defined. Undergraduate and postgraduate surgical training may have to be developed simultaneously as the first medical students will soon begin the clinical phase. Similarly, other residency training programs, such as emergency medicine, have asked for surgical rotations to be

developed for their programs, also taking place at PMH. Greater numbers of trainees will be an additional challenge with respect to case load. Licensing of graduates and program accreditation have not yet been addressed. Ongoing dialogue will be vital as these challenges begin to be faced if this surgical training program is to be implemented successfully.

The bulk of the work in establishing a new surgical training program in Botswana lies ahead. Our curriculum design currently addresses only knowledge and technical ability. Ultimately, other competencies will need to be addressed, as for example those defined by CANMEDS roles [14] or ACGME competencies [15]. Both CANMEDS and the ACGME competencies identify additional roles for physicians (and surgeons), including communication, collaboration, and managerial skills, among others. Our aim has been to contribute to an open discussion of our efforts to improve access to surgical care in low income and middle income countries through efforts to improve surgical education. We propose that our approach to the design of a curriculum for Botswana may serve as a model for designing a contextually relevant surgical training curriculum in other low-resource settings. Our model is simple and inexpensive. Surgical logbooks are often available, and their analysis can be carried out with a simple database. Combining local data with a simple curricular framework, under the guidance of contextualized expert opinion, can yield a locally relevant program.

References

- World Health Organization (2009) World Health Statistics 2009. <http://www.who.int/whosis/whostat/2009/en/index.html>. Accessed 7 April 2009
- Mullan F (2005) The metrics of the physician brain drain. *N Engl J Med* 353:1810–1818
- Pereira C, Cumbi A, Malalane R et al (2007) Meeting the need for emergency obstetric care in Mozambique: work performance and histories of medical doctors and assistant medical officers trained for surgery. *Br J Obstet Gynaecol* 114:1530–1533
- Sani R, Nameoua B, Yahaya A et al (2009) The impact of launching surgery at the district level in Niger. *World J Surg* 33:2063–2068. doi:10.1007/s00268-009-0160-x
- Van Amelsfoort JJC, Van Leeuwen PAM, Jiskoot P et al (2010) Surgery in Malawi—the training of clinical officers. *Trop Doctor* 40:74–76
- Choo S, Perry H, Hesse AAJ et al (2011) Surgical training and experience of medical officers in Ghana's district hospitals. *Acad Med* 86:529–533
- Loeffler IJP (1998) A short history of surgical training in eastern Africa. *East Cent Afr J Surg* 5:55–61
- Khambaty FM, Ayas HM, Mezghebe HM (2010) Surgery in the horn of Africa: a 1-year experience of an American-sponsored surgical residency in Eritrea. *Arch Surg* 145:749–752
- Cameron BH, Rambaran M, Sharma DP et al (2010) The development of postgraduate surgical training in Guyana. *Can J Surg* 53:11–16
- Keavu I, Watters DAK (2006) Specialist surgical training in Papua New Guinea: the outcomes after 10 years. *ANZ J Surg* 76:937–941
- Pollock JD, Love TP, Steffes BC et al (2011) Is it possible to train surgeons for rural Africa? A report of a successful international program. *World J Surg* 35:2175–2176. doi:10.1007/s00268-011-1189-1
- World Health Organization (2009) Botswana health profile. <http://www.who.int/gho/countries/bwa.pdf>. Accessed 20 Aug 2011
- Surgical Council on Resident Education (2010–2011). General Surgery Residency Curriculum Outline—Patient Care and Medical Knowledge. www.surgicalcore.org. Accessed 1 June 2011
- Frank J (2005) The CanMEDS 2005 physician competency framework. Better standards, better physicians, better care. Royal College of Physicians and Surgeons of Canada, Ottawa
- Batalden P, Leach D, Swing S et al (2002) General competencies and accreditation in graduate medical education. *Health Aff (Millwood)* 21:103–111