BUILDING CAPACITY FOR CANCER TREATMENT IN LOW-INCOME COUNTRIES WITH PARTICULAR REFERENCE TO EAST AFRICA


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(TWO WORLDS CANCER COLLABORATION)

Cancer rates are presently increasing in low-income countries such as East Africa and are highly likely to continue to do so. If this ever-increasing burden is to be controlled, it will be particularly important to address the need for cancer specialists, and to plan for efficient and widely accessible cancer services. Alternative pathways for training, which are hospital rather than university-centred should be considered. Teaching would be largely "on-the-job training" with trainee specialists having patient responsibilities, supervised as necessary, as well as access to educational materials designed for self-learning, and on-line information. This approach should increase the number of specialists trained without reducing the number of doctors available for patient care, although a new accreditation process will be necessary. In addition, national early diagnosis programmes should be established, thus minimizing the need for complex surgery, chemotherapy and radiation, while task-shifting and oncologist-led teams of health professionals will increase the efficiency of care and maximize survival rates.

According to Globocan predictions, cancer incidence will continue to increase throughout the world for the foreseeable future.[1] Yet countries differ enormously in socioeconomic status (over a range of several hundred-fold) and therefore in their capacity to recognize and overcome obstacles to development. In this article, East Africa is taken as an example of a small group of countries with limited development (Table 1) facing many obstacles to effective care of cancer patients. Demographic changes alone in the five East African countries combined are projected to result in 521,240 new cases in 2030, i.e., an increase of 81% over the 2012 estimate of 287,264.[1] The corresponding mortality figures are 380,730 and 208,456. Prevention of cancer is an essential component of cancer control and vaccination against cancer-causing viruses and tobacco control will doubtless be components of each national cancer control plan, but potentially curative treatment cannot be ignored for patients who develop cancer. This article will deal exclusively with obstacles faced by the medical community charged with reducing the number of people who die from cancer and particularly with the shortage of specialists involved directly in the treatment of cancer.

Obstacles to increasing the capacity to diagnose and treat cancer

Socioeconomic development

The major obstacle to reducing the mortality from cancer in East Africa is the limited socioeconomic development of these countries. When the components of the Human Development Index (HDI), namely, longevity, level of education and income[2] are examined separately, it is clear that they interact strongly. Poor education of health care providers and the public gives rise to poor health care, whilst ill-health has an important impact on the ability to learn and to earn. Health and education are strongly influenced by poverty, which modifies exposure to risk factors for ill-health and reduces access to health care. Many factors influence access, including few primary care providers close to home (as many as 70% of people in East Africa may first consult traditional healers) lack of public knowledge about cancer and concern about the cost of cancer care; loss of income coupled to the cost of travel and accommodation and fear of cities (approximately 80% of people in East African live in rural districts). Transportation is very difficult – journey times are inordinately long and uncomfortable. While some of

Table 1: **UNDP HDI, 2012**

	Burundi	Rwanda	Uganda	Tanzania	Kenya
HDI	0.355	0.434	0.456	0.476	0.519
Rank	178	167	161	152	145
GDP (Current US$, billions)	2.47	7.10	20.03	28.24	40.70
Physicians per 1,000 people	ND	0.1	0.1	0.1	0.2

HDI maximum score, 1. Norway's HDI was 0.921 in 2012; GDP figures are for 2012 – UK GDP = 2,476 trillion; UK physicians per 1,000 people = 2.7 (2010/2011); ND = No data

these issues are, or have been partially addressed (e.g., half price bus tickets for cancer patients and free treatment for children less than five-years old in Tanzania), such funds must come from the government and are not always available. Even if families overcome these obstacles, they face the challenge of extremely limited numbers of nurses, doctors and pharmacists, and remarkably few cancer specialists (Tanzania has, for example, a single trained medical oncologist, no trained paediatric oncologist, two or three radiation oncologists and perhaps 18 pathologists, almost all working in major cities).

Access to specialist health services

Unlike other non-communicable diseases, some patients with cancer are curable through access to earlier and more accurate diagnosis, specialist consultation and therapy. Drugs vary markedly in price, even within the same country, and may sometimes be higher than in the United States or Europe. This precludes many regimens since most patients must generally pay out-of-pocket for all diagnostic and treatment costs. To address this situation, the methods of education, the division of labour and the delivery of health services, including cancer services, will need to be markedly improved. Considerations include:

- enactment of equitable policies to subsidize the costs of care e.g., universal health care;
- insurance schemes;
- diagnostic and therapeutic co-pay;
- increased practical responsibility for medical assistants, nurses and community health workers;
- shortening of training periods for health professionals;
- incentivization for practice in rural regions e.g. locating medical and nursing schools in rural regions, required rural service periods for health professionals and rural living subsidies;
- re-focusing and re-balancing the mix of academic (degree-based), discipline/competency-based training (professional certification) and practical service delivery.

Medical professional migration

Higher-resourced countries recruit extensively from lesser-resourced nations despite these countries having major shortages of health workers.[3] Concomitantly, although not at a high level of development, some countries (e.g., India) have well-equipped and staffed hospitals, generally in the private sector, that are able to attract patients from high resource countries for surgical procedures or to provide services such as interpretations of electronically-transmitted images (radiographs, etc.). Accordingly, an additional proportion of the skilled health care providers, already too few to meet national needs, are lost to their own country. The least developed countries cannot compete in this market, although many African doctors choose to work (sometimes to train and work) in countries with higher levels of development. The solution is to improve the overall level of care in regions such as East Africa. This process will proceed much more rapidly when external educators spend time in countries with limited development, or at least assist them through teleconferences, etc. Institution-to-institution collaborations ("twinning") between a high-resource and lesser-resourced country can be of great value (see article by Raul Ribeiro), However, international institution-to-institution programmes are unlikely to promote the building of networks required to strengthen services across health sectors.

Cancer treatment: Shared care among specialists and hospitals

Drugs and equipment are of no value without knowledgeable health professionals, particularly oncologists who can make treatment decisions and work with a team comprised of pharmacists, oncology nurses, junior doctors, medical assistants and social workers. Unfortunately, it can be difficult or impossible to create such teams when there is no oncologist to take a leading role. An European Society for Medical Oncologists survey (2006) reported that only 22 countries of the 39 respondents were able to state how many oncologists there were in the country and of those who could provide figures, the number of oncologists per million cancer

cases varied markedly up to 3,000 new cancer cases per year per oncologist.[4] If cancer treatment is to be improved, training more oncologists must be one of the highest priorities.

Cancer may involve any part of the body. Optimal diagnosis and treatment requires several specialists with different skills and knowledge, including pathologists who make the diagnosis,[5] and often several cancer specialists, depending upon the type of cancer. Surgical specialists cover a defined anatomical region or "system" (e.g., gynaecologists, orthopedic surgeons, neurosurgeons), but may specialize further to deal exclusively with cancer in those regions. Other specialists are expert in particular therapeutic approaches, such as radiation oncologists (radiation therapy), medical oncologists (systemic therapy), or clinical oncologists (trained in both). Determination of the local extent of cancer and the presence of distant metastases requires evaluation by imaging specialists. In well resourced countries, radiologists and nuclear medicine specialists are always involved in the care of cancer patients. The lesser resourced countries, however, may have to rely on clinical examination only, or clinical examination supplemented by ultrasound and/or simple X-rays to determine optimal therapy. Computerized tomographic scanners, magnetic resonance imaging and nuclear medicine scans are in short supply and in East Africa, for example, available at only a handful of public hospitals. For-profit private hospitals are more likely to have such equipment.

Cancer surgery often involves radical procedures that general surgeons are generally not trained to do. As systemic therapy continues to improve, however, and is incorporated into the treatment of cancers formerly treated by surgery (or sometimes radiation therapy) alone, surgical procedures for cancer are becoming less radical, and associated with less morbidity.[6,7] Adjuvant (post-surgical) and neoadjuvant (pre-surgical) systemic therapy may permit less extensive surgery since the tumour volume may be much smaller after chemotherapy since resection margins can be small when post-surgical systemic therapy is planned. In such cases, surgery may often be performed by general surgeons, although it is essential that combined modality therapy of this kind is managed by an oncology team. Similar considerations apply when radiation is associated with chemotherapy. Haematological cancers are treated less and less with radiation therapy, even when this was the primary modality in past years[8,9] and surgery is rarely indicated, so that cancer care can be designed exclusively by haematologists, medical oncologists or clinical haematologists. The very limited number of radiation therapy units (in Tanzania there are six machines for 40 million people; four are not yet functional), and their high capital cost coupled to the need for highly skilled radiation therapists, physicists and technicians suggests that as new units are established, one area worthy of research is the re-examination of the need or extent of radiation in the modern era of systemic therapy. The demonstration that radiation can be replaced by systemic therapy in some diseases or stages of disease, would lead to a reduction in the number of specialized radiation therapy units and their associated specialists required. However, a project of this kind would need considerable development of research infrastructure and a more scientific approach to cancer care than presently exists.

The critical importance of early diagnosis

It is generally true (there are exceptions) that patients with small volume, localized disease can be more effectively treated (i.e., are more likely to be cured, or at least have longer survival) regardless of the modality(s) employed. Early detection, then, should generally lead to better results within the existing health care system at less cost and inconvenience. Since early detection requires both a more knowledgeable public and improved referral patterns for diagnosis and treatment, an emphasis on education of the public and medical community may be the single most important action to be taken if better survival rates are to be achieved. Moreover, primary cancer prevention also requires public education, and economies of scale could be obtained by combining primary and secondary prevention. Organized approaches to needed education should, therefore, be built into the cancer control plan, and referral guidelines and networks developed. Greater efficiency in detection and diagnosis should be feasible in all countries, but requires planning and individuals dedicated to developing the necessary educational tools.

Educating oncologists – the rapid expansion of training opportunities

Although the training and professional efficiency of cancer specialists may be assisted by visiting experts, this practice is highly unlikely to meet the global need for oncologists and other cancer professionals. Self-sufficient and sustainable solutions are required.

A partial and time-honoured approach to the training of specialists is "learning by doing", e.g., gaining experience in the practice of oncology through working with a recognized oncologist. The creation of one or more national organizations comprised of health professionals – "colleges," "academies" or "boards" – involved in cancer care, but which

Table 2: **Medical schools in East Africa**

Name (date founded)	Approximate class size	Relevant postgraduate degrees	Population in thousands[1]
UGANDA			**40,141**
*Busitema University Medical School	NP	None at Present	
Gulu University Faculty of Medicine (2004)	44	MMed (Surgery)	
Mbarara University Medical School (2004)	61	MMed (Int Med)/MMed (Peds and Child Health) MMed (Ophth) /MMed Obst/Gyn	
*St Augustine International University, College of Health, Medicine and Life Sciences	NP	NP	
*School of Medicine, Kampala International University (2006)	62	None	
School of Medicine, Makerere University College of Health Sciences (1923)	113	MMed (Int Me)/MMed (Surgery) MMed (Peds)/MMed (Neurosurgery) MMed (Obst/Gyn)/MMed (Ophth) MMed (ENT)/MMed (Med Onc) MMed (Surg Onc)	
Mutesa I Royal University Faculty of Medicine, Health Sciences and Health Services	Scheduled to open in 2015		
*Kumi University School of Medicine	In the planning stages		
*Uganda Martyrs School of Medicine (2010)	NP	MMed (Int Me)/ MMed (Surgery) MMed (Peds)/MMed (Obst/Gyn)	
TANZANIA			**52,251**
*Hubert Kairuki Memorial University (1997; accredited 2006)	42	None	
*International Medical and Technological University (IMTU)	26	None	
Kilimanjaro Christian Medical College (1998)	24	NP	
School of Medicine, Muhimbili University of Health and Allied Sciences (1968)	201	MMed (Clinical Onc)/MMed (Haem and BT) MMed (Int Med)/MMed Obst/Gyn) MMed (Ophal)/MMed (Orthopedics) MMed (ENT)/MMed (Peds) MMed (Surgery)/MMed (Anatomic Path)	
*Weill Bugando University College of Heath Sciences (2003)	NP	NP	
KENYA	**9**		**46,749**
Kenyatta University (2008)	289	Master of Medicine (all specialities)	
*Medical College Aga Khan University East Africa	Scheduled to open in 2015		
Moi University School of Medicine (1990)	75	MMed (peds)/ MMed (Int Med) MMed (Orthopedics	
University of Nairobi, Faculty of Health Sciences (1983)	NP	NP	
RWANDA			**12,428**
Faculty of Medicine, National University of Rwanda (1963)	90	NP	
BURUNDI			**10,813**
Faculty of Medicine, University of Burundi (1968)	97	NP	

**indicates Private University. NP= information not provided. Data obtained from the sub-Saharan African Medical Schools Study (http://www.samss.org/?home) and in some cases Wikipedia either exclusively (e.g., most of the private universities), or in addition to SAMSS. Information may change. Last accessed 4/7/2014*

NB. Class size is approximate – numbers may vary from year to year
Population estimates are medium variant estimates obtained from the United Nations Population Division for 2015

are outside the university system and function in a similar way to those that have long existed in more developed countries would be necessary to put this approach onto a formal footing. The primary focus would be "competence-based" i.e., education, training and knowledge assessment strongly focused on clinical care. Such institutions would require government approval and independent accreditation, but could be entirely separate from the government. Their responsibility would be ensuring that health care providers beyond the primary level are appropriately qualified, have access to continuing education, adhere to the professional standards set and are accountable for their actions. They would not provide treatment, although they could well act as conveners for committees and assume responsibility for developing national referral guidelines, patient "care-paths" and standardized treatment regimens. The limiting factor in the establishment of such bodies is the small size of the oncological community in countries with limited resources. This might be overcome by creating international organizations of this type, such as the recently inaugurated Hematology and Oncology Society of Africa (HOSA).[10] International organizations would have the added potential to create standards of care and curricula for trainees, as well as the provision of examiners across many African nations.

University training lasting one to three years can seriously deplete the already insufficient number of health professionals in countries where most or all post-graduate training is conducted in universities and the contribution of trainees to patient care is small. In addition, a limited number of university places as well as specialist training programmes exist at each university (Table 2), which may lead to unbalanced capacity building. The extreme shortage of oncologists in regions such as East Africa could be addressed by very short periods of training for doctors, or even medical assistants, in the diagnosis or management of a single type of a common cancer. Clinical training and procedures, e.g., spinal taps and bone marrow exams would be done "at the bedside." Trainees would be exposed to the cancers more frequently in their own country and learn to practise in a resource-limited environment rather than in the relatively luxurious settings of foreign institutions, or the artificial environment of the classroom neither of which prepare them for the devastating realities of limited or absent resources.

In a non-university setting, training could be done in any cancer centre or unit. Oncology sub-specialties, especially, may be best taught in the course of supervised patient care in cancer institutions. Alternative cancer specialist educational pathways of this type would mean that more specialists could be trained without a reduction in access to cancer care during the training period. Training in a cancer centre would encourage the simultaneous development of inter-disciplinary teams, to ensure patient-focused care and relief of workload pressure on the oncologist. Specialists would not necessarily give up caring for patients with non-malignant conditions, and surgeons, for example, might continue to see other patients whilst undergoing training in surgical procedures for cancer. Some task-shifting may be necessary to enable physicians to focus on those aspects of care that only they can undertake while nurses or medical assistants with specialized training – again, of the "bedside" type – would undertake the delivery of chemotherapy and perform procedures e.g. spinal taps and even endoscopies normally performed only by doctors. In the long run, the training and employment of social workers disciplines involved with rehabilitation and "trackers" who ascertain the status of patients who have completed therapy should increase efficiency as well as provide improved data on survival rates.

Certification

To ensure appropriate standards, a process for assessing professional competence would need to be developed, ideally involving external examiners and certification of those who meet the requirements. The focus of university education would rightfully become academic education and research. Once certified, junior specialists (assistant or associate oncologists?) could aspire to become "fully trained" oncologists with a broader clinical knowledge base, equipping them to undertake a leadership role in cancer treatment. Associate oncologists practising outside the specialist oncology centre could develop an interdisciplinary oncology team across the tertiary-community interface. Constant augmentation of knowledge could be assured by a programme of continuing education (involving credits), consisting primarily of inter-hospital clinico-pathological case conferences or lectures/discussions on issues of care. If accepted as an alternative to a post-graduate university degree, all hospitals with a trained oncologist could be involved in teaching, as well as service provision, thereby overcoming some of the obstacles that currently exist.

Root problems in the development of higher education

In East Africa, approximately 50% of the population is less than 15 years of age. This has an impact on both the economy and education, since productivity and government income in the form of taxes are both low and the need for teachers at all levels is high. In the last decade, improvements in the number of children completing primary education (although still

averaging less than 70% in East Africa has caused a "bottleneck" in secondary education, overwhelming the number of available places. Teaching quality for children in their second decade of life is low and many children suffer or have suffered from malnutrition and anemia, which are known to impair cognitive development, limiting the ability to learn. Up to 80% of the population live in rural regions where services are more difficult to provide over the large areas that must be covered. Out-of-school rates vary from 2% in Tanzania to 44% in Equatorial Guinea and are twice as high in girls. These problems significantly reduce youth and adult literacy rates, which are in the 50–90% range and lower in females than males.

While many solutions are possible, one worth considering would be the establishment of pre-medical schools to provide the equivalent of secondary education at any age, thus increasing the fraction eligible for a university education and increasing the output of trained doctors, and in turn, a larger pool of individuals for specialist training. UNESCO is leading an effort to broaden access to education through its "Education for All Program (EFA)"[11] and there are high hopes for the Pan-African University launched in three African countries (Kenya, Cameroon and Nigeria) in 2012. Although progress is being made, 31 countries in sub-Saharan Africa will reach the goals of the EFA programme only after 2020. Uganda, for example, has four public and five private universities with medical faculties, Tanzania two public and three private, and Kenya three public and one private university planning to initiate medical undergraduate training next year. Average class size in Uganda is 280, in Tanzania 302.[12] Recognizing that many doctors who graduate will migrate, a higher class intake is necessary to meet national needs. Improving higher education in Africa will take time, but it must be recognized that part of the problem is the limited number of young people with sufficient education to go to university and too few appropriately qualified university teachers to educate them.

Use of informatics for education and care

Hospital-led educational programmes for specialists do not require that practising oncologist give up their attendance at lectures or other formal education sessions. A significant proportion of the knowledge required by a specialist can be provided by distance-learning (educational institutions are thus, no longer defined by bricks and mortar, but by potentially widely dispersed teachers and students). The same teaching materials, vetted for accuracy, whether developed in country, or by external experts, may be used in many different centres across the country whether delivered on-line, via CD or DVD, or downloaded to a computer or mobile platform. Students can choose, depending upon their clinical responsibilities, when and where to study, how frequently to review difficult elements and how to become increasingly informed without compromising patient care responsibilities. In addition, built-in test materials can enable a student to assess their own progress and repeat elements of the curriculum on which their personal test scores are low. Mobile platforms (smart phones and tablets) may also include reference materials too bulky to transport in hard copy, such as treatment protocols, drug side effects, etc. Having a library of information at "one's finger tips" saves time and effort looking for information in a physical library (which, in any event, is likely to be poorly stocked). Laboratory results, imaging studies and pathology reports can be made available electronically and there is less risk of losing patient information than when this is purely paper-based. The International Atomic Energy Agency is building a "Virtual University and Training Network for Cancer Control in Africa" which could greatly increase access to educational materials regardless of their location.[13] INCTR's OERC Programme (see elsewhere in this volume) could also increase accessibility to on-line reference materials. •

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