Practicing pathology in a resource-poor setting presents many challenges that are unfamiliar to pathologists in developed countries. Typically, the number of pathologists in a resource-poor country is small, even as a percentage of the total medical workforce. Although pathology should play a central role in the delivery of appropriate health care to the patient, this role is often hidden and not well recognized by patients, clinical colleagues, or other stakeholders, such as administrators and politicians. The public tends to think of the pathologist as the “Doctor of the Dead.” The financial rewards are also small. Consequently, it is difficult to recruit physicians into pathology. The lack of human and material resources allocated to pathology leads inevitably to a large gap in health care for many patients, with an unmeasured negative effect, at both the individual and societal levels. Correct management of the patient, even when available, is not administered because of the lack of pathologic information. Surgery may be performed without the benefit of preoperative or postoperative pathologic confirmation of the diagnosis, let alone identification of important prognostic information. The pathologist plays a key role as an educator in developing countries to medical students, allied health professionals, and medical colleagues and is, therefore, called upon to provide many hours of teaching. The pathologist is uniquely qualified to provide knowledge and understanding regarding the diseases in the region where he or she practices. Although many of these challenges are universal, they are perhaps nowhere more acute than in resource-poor settings.


The United Republic of Tanzania is a sub-Saharan country that measures about 945,000 km², with a population of 39,459,000, according to the World Health Organization estimate for 2008. The country was formed in 1964 as a union between the former Tanganyika and the islands of Zanzibar. Tanganyika gained its independence from the United Kingdom in 1961 and Zanzibar from the Sultan of Oman in 1964. Initially, the political system was that of a one-party state with a socialist ideology. In recent years, multiparty elections have been held, and there has been a gradual process of economic change in a stable political environment. Since independence, Tanzania has worked hard to establish and improve its health care system. Initially, all health services were offered free of charge. A change in policy, instituted in 1995, required individuals to contribute to the cost of their care, excluding certain groups, such as children younger than 5 years of age, pregnant mothers, and the elderly, as well as patients suffering from chronic diseases, such as diabetes, tuberculosis, and AIDS. Tanzania has 22 regions, organized in 5 zones and 121 districts. The physician to population ratio is 1:23,000, one of the lowest in the world and lower than in the neighboring countries.

Health services are stratified, starting with the local dispensary, progressing through health centers, district hospitals, regional hospitals, and at the highest level, referral hospitals. Specialized care is generally only delivered at the referral hospitals, and that is where most specialist physicians work, including pathologists. Training of physicians and the education of medical students occur principally in the referral hospitals. Forensic medical services are primarily organized at the referral hospitals, although some forensic services are also available—although strictly not permitted—at the regional and district levels by medical officers and assistant medical officers. The territory is vast, and transportation is frequently difficult; consequently, referrals of forensic cases to centers with facilities and trained personnel tend to occur infrequently.

DISEASE BURDEN IN TANZANIA AND THE LAKE ZONE

Although communicable diseases, including zoonotic diseases, remain the major cause of morbidity and mortality in Tanzania, chronic diseases, such as diabetes, heart disease, and cancer, are also important and increasing in frequency. Malnutrition contributes significantly to morbidity and mortality in infants and children. Human immunodeficiency virus continues to spread, although the levels are not as high as in many other African countries.

Cancer of the cervix is the leading malignancy in women in Tanzania, as in most other African countries, and has been shown to have a high prevalence among women who are positive for human immunodeficiency virus.
Childhood cancers are an important challenge and account for about 11.5% of all cancers in Tanzania. There is a high incidence of pediatric malignant lymphomas, in particular, Burkitt lymphoma. Breast cancer is less frequent than in western countries, although the incidence may be increasing. The relative frequency of male breast cancer is high. Observations in several African countries indicate that breast cancer in African women may be unusually aggressive and that it may present at a relatively young age. African breast cancer may also have a different hormone receptor profile than its western equivalent. Salivary gland tumors have been reported to be more common in Tanzania than in western countries. Conjunctival squamous cell carcinoma also occurs with increased frequency, likely related to sun exposure, but possibly aggravated by human immunodeficiency virus infection. Squamous cell carcinoma of the bladder, associated with *Schistosoma haematobium* infection, is seen in the northern regions, including Mwanza. The Lake zone significantly resembles the rest of Tanzania in disease burden. Diarrhea, hepatitis, and zoonotic diseases are quite common. No specific data exist for cancer incidence in the western and Lake zones of Tanzania.

**Pathology Services in Tanzania**

Tanzania has 4 referral hospitals that serve 22 regions: the Muhimbili National Hospital, located in Dar es Salaam city, serves the eastern zone; the Kilimanjaro Christian Medical Centre, located in Kilimanjaro (Moshi town), serves the northern zone; Bugando Medical Centre, located in Mwanza City, serves the western and Lake zones; and Mbeya Hospital, which serves the southern highlands, is located within Mbeya City. This is the highest level of hospital services in the country, and this is where pathology services are offered. The University of Dar es Salaam is the site of the country’s largest medical faculty; medical schools are also affiliated with Kilimanjaro Christian Medical Centre and Bugando Medical Centre. The Ocean Road Cancer Institute in Dar es Salaam provides countrywide referral services and is the sole provider of radiotherapy in Tanzania. The 4 referral hospitals offer laboratory services, including histopathology, hematology, clinical chemistry, and forensic medicine.

Tanzania has only 15 pathologists (or 1 per 2.5 million people) with an uneven geographic distribution in these referral hospitals. Two of the 15 pathologists (13%) are specialized forensic pathologists, and 2 are hematopathologists (13%) from the Muhimbili National Hospital. Mbeya Hospital and Kilimanjaro Christian Medical Centre referral hospitals have 1 pathologist (7%) each, whereas Bugando Medical Centre has 2 pathologists (13%). The remaining 7 pathologists (47%) are based at Muhimbili National Hospital in Dar es Salaam, the main urban centre and the largest city in Tanzania. As is evident from these numbers, the pathologists are not able to serve the population in a comprehensive way. Many cases never involve a pathologist and are either treated without a pathologic diagnosis or are not treated at all. The relative paucity of verified pathologic diagnoses inevitably detracts from the reliability of disease statistics, perhaps particularly, for cancer.

**Pathology in Mwanza**

Bugando Medical Center and Bugando University College serve the population of the Lake Victoria region of Tanzania, which comprises Mwanza, Mara, Kagera, Shinyanga, and Kigoma regions. Bugando Medical Center is an 800-bed hospital serving the Lake zone of Tanzania, which has a population of more than 10 million. Two pathologists provide histopathology, cytology, and forensic pathology services and teach the university students. When the hospital was established, all histopathology specimens were sent to Muhimbili Hospital in Dar es Salaam, Tanzania, for processing and interpretation. In 2000, a Pathology Department was established at Bugando Hospital in collaboration with the Vittorio Tison Association of Italy. Initially, pathology diagnostic services were provided entirely by visiting pathologists from Bologna, Italy. Histopathology specimens, including referrals from district and regional hospitals in Lake zone, were collected and kept until the visiting pathologist was able to see them. The turnaround time was often, inevitably, quite long and depended on the availability of the volunteer pathologists. Urgent specimens were sent to Dar es Salaam, Tanzania.

When Bugando University Health Centre was established in 2003, an urgent need arose for pathologists to provide teaching and pathology services in the Lake zone of Tanzania. As a result, 2 physicians underwent a 3-year master of science program in pathology at Makerere University (Kampala, Uganda) sponsored by Bugando University Health Centre and the Vittorio Tison Association. Since their return to Bugando University Health Centre in 2006, there have been rapid and significant changes, including a dramatic increase in surgical pathology specimens received by the department. Fortunately, visiting pathologists from Italy continue to make important contributions to the service. The turnaround time for specimens has improved, although there is some constraints like reference work on difficult cases, special stains or recuts, and/or the need for external consultation. This can lead to a delay of weeks to months. On the other hand, the usual cases are usually completed in 5 days and cytology examinations in 3 days. Still, depending on the workload, routine cases may take up to a week.

The Bugando University Health Centre Pathology Department receives approximately 3000 surgical specimens annually and close to 800 cytology specimens, 75% of which are fine-needle aspiration biopsies. The remaining cytology specimens consist almost entirely of abnormal cervicovaginal smears. Approximately 300 autopsies are performed; most of those consist of forensic cases. The department has 2 histotechnologists and one prossector. Most of the laboratory work is done manually, except for the tissue processing, for which an automatic tissue processor (Miles Laboratories Inc, Sakura Fine technical Co Ltd, Japan) is employed. Technical facilities remain limited, and most cases are interpreted based on hematoxylin-eosin stains only. The special stains available include periodic acid–Schiff, Ziehl-Nielsen, Giemsa, and, rarely, silver stains. There are very limited numbers of antibodies available for immunohistochemistry, and there are no molecular diagnostic facilities. Many of the surgical specimens represent advanced and rare or challenging cases; the need for collegial consultation, therefore, arises frequently.

Bugando University has undergraduate medical students and 20 postgraduate students (residents), all of whom need to study pathology at some point in their
training. The Institute of Allied Health Sciences has 479 students undertaking a diploma in various fields of health care who also require instruction in pathology. These various teaching activities add approximately 25 hours to the weekly workload of the 2 pathologists. The pathologists are also involved in administrative duties and, as faculty members, are expected to make academic contributions in research and publications. The high workload inevitably leads to a chronic backlog of cases, which, in turn, carries the risk of delays in important diagnoses.

CONCLUSION

Clearly, there is a great need for increased recruitment of pathologists to provide essential services and teaching in Tanzania. In addition, there is a need for much more research activity to address the numerous questions about the pathology of many diseases and their unique expression in African patients. This recruitment will, of necessity, be costly, as will be the much-needed investment in facilities and techniques. In the short term, we will continue to rely on visiting volunteer pathologists to help with the rapidly rising workload. Telepathology techniques are a promising method of consultation, and we will undoubtedly make increasing use of it in the future. In the long term, we need to train pathologists who are attuned to the local challenges while, at the same time, are able to apply modern skills and knowledge to the provision of services and the advancement of knowledge.

I thank the people who have encouraged and aided me in the preparation of this work, in particular, Mange Manyama, MD, Hallgrimur Benediktsson, MD, and Professor Cassian Magori, MD, PhD.

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