Oncologic Care and Pathology Resources in Africa: Survey and Recommendations

Ann M. Nelson, Danny A. Milner, Timothy R. Rebbeck, and Yawale Iliyasu

ABSTRACT

The connection of a clinician who identifies a patient with signs and symptoms of malignancy to an oncologist who has the tools to treat a patient’s cancer requires a diagnostic pathology laboratory to receive, process, and diagnose the tumor. Without an accurate classification, nothing is known of diagnosis, prognosis, or treatment by the clinical team, and most important, the patient is left scared, confused, and without hope. The vast majority of deaths from malignancies occur in sub-Saharan Africa primarily as a result of lack of public awareness of cancer and how it is diagnosed and treated in the setting of a severe lack of resources (physical and personnel) to actually diagnose tumors. To correct this massive health disparity, a plan of action is required across the continent of Africa to bring diagnostic medicine into the modern era and connect patients with the care they desperately need. We performed a survey of resources in Africa for tissue diagnosis of cancer and asked quantitative questions about tools, personnel, and utilization. We identified a strong correlation between pathology staffing and capacity to provide pathology services. On the basis of this survey and through a congress of concerned pathologists, we propose strategies that will catapult the continent into an era of high-quality pathology services with resultant improvement in cancer outcomes.

INTRODUCTION

Pathology has been a bottleneck in the provision of appropriate clinical care in resource-constrained settings. Nowhere has this problem been more acute than in sub-Saharan Africa (SSA). As a result, clinical care has suffered at all levels. Adesina et al summarized the consequences of limited pathology in low-resource settings. In primary care, inadequate pathology leads to mis- or underdiagnosis that leads to inadequate referral. At referral centers, inadequate diagnosis and follow-up can result. Thus, inadequate pathology results in treatment delays, poorer clinical outcomes, and suboptimal use of limited resources. The lack of pathology also leads to inadequate reporting of disease rates, which leads to inadequate knowledge of cancer incidence, prevalence, and mortality that limits the ability to plan for medical care needs. Thus, the settings in which medical resources most need to be carefully used are those in which the least data are available for appropriate resource planning.

The limited state of pathology in SSA is a consequence of many factors, including periods of political instability in some locations and limited economic resources to develop and maintain high-quality facilities. These factors affect many areas of health care. However, pathology also suffers from perceptions and biases that further limit its development. Many individuals, from laypersons to physicians, in SSA perceive of the discipline of pathology by its forensic pathology activities, including autopsy. Unlike some areas of clinical practice, pathology is not a commonly known or widely understood discipline in the general population. Change in the perception of pathology and education about its value are major needs in low-resource countries. This education is needed in health care settings, among clinicians, and in ministries of health and other government agencies. The goal of this education would be to improve training, recruitment, and retention of pathologists and to increase capacity for pathology services.

Low-resource countries, particularly those in SSA, must develop self-sustaining systems to support pathology capacity that capitalize on using the right resources in the right places. Moreover, specific cancers in Africa may require basic or clinical research to find therapies and solutions to delivering those therapies optimally on the continent. In this report, we have performed a survey of current resources and summarize the state of pathology capacity for oncologic care. We have also attempted to provide a summary of the steps that need to be taken to create these self-sustaining systems.
METHODS

An online survey of pathology capacity in SSA was conducted between 2011 and 2013. Surveys were available in English, French, and Portuguese. The link was sent on several occasions to more than 200 pathologists, including those in Africa and those collaborating in Africa. These individuals were identified by membership lists from the International Academy of Pathology and African Organization for Research and Training in Cancer or were individuals known to the members of African Strategies for Advancing Pathology (ASAP). In total, we received 67 responses from 48 unique institutions in 26 of 44 SSA countries. Data were also obtained by telephone and e-mail from 10 additional countries that did not respond to the survey. Thirteen of the ASAP participants assisted in identifying specific individuals in those countries and assisted in the validation of the information reported here. ASAP members provided information about the eight countries with no pathology services.

The information requested included numbers of pathologists and technicians, training positions, workload and workflow, and infrastructure and availability of cancer care (oncologists, chemotherapy, and radiation therapy).

The complete survey (in four languages) can be found at the Pathology Situation Analysis Web site (http://goo.gl/ZFr6k). The data were organized by region (East, West, South, and Francophone Africa). Duplicate responses from the same institution were combined and verified. The data are displayed on interactive Table 1.

### Table 1. Results of African Pathology Centers Survey by Country: Providers and Services

<table>
<thead>
<tr>
<th>Country</th>
<th>Population (No.)</th>
<th>No. of Persons per Pathologist</th>
<th>Pathologists</th>
<th>Histopathology Technicians</th>
<th>Cytopathology Technicians</th>
<th>Oncologists</th>
<th>IHC</th>
<th>Molecular</th>
<th>Chemotherapy</th>
<th>Radiation Therapy</th>
<th>% of Cancers With Pathologic Diagnosis</th>
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<td>7</td>
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<td>Y</td>
<td>Y</td>
<td>Y</td>
<td>&lt; 10</td>
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<td>Y</td>
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<td>10-50</td>
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<td>N</td>
<td>N</td>
<td>Y</td>
<td>Y</td>
<td>10-50</td>
</tr>
</tbody>
</table>

**NOTE.** Empty cells indicate no response or no data available. There are no public sector pathologists in Equatorial Guinea, Gambia, Guinea, Guinea-Bissau, Lesotho, Liberia, and Swaziland.

**Abbreviations:** IHC, immunohistochemistry; N, no; NA, not available; Y, yes.

*Technicians have bench training only.
†Pathologists do cytology screening.
‡Technologists do histology and cytology.
§Medical and surgical oncologists.
‖General surgeons also practice some oncology.
¶Oncology fellowships.
maps and charts using FusionMaps and FusionCharts (InfoSoft, Kolkata, India) linked to a MySQL database (Oracle, Washington, DC). This article focuses on provision of cancer care and does not cover all data collected in the survey.

A congress was held in Siena, Italy, from May 31 to June 4, 2014, which included representatives from Australia, Burundi, Cote d’Ivoire, Italy, Kenya, Mozambique, Nigeria, South Africa, Tanzania, Uganda, the United Kingdom, and the United States. The participants were selected because of their long experience in working in African pathology, leadership roles in current African pathology organizations and institutions, and reputation for participation in groups previously concerned with pathology infrastructure in Africa. The group met under the direction of a professional meeting facilitator with the goal of brainstorming strategies for effecting change in African pathology globally. As part of this work, specific recommendations concerning advancing oncologic care were put forward as action items. A summary of those recommendations are provided to support the data discovered by the survey, and a call to action has been generated.1

**RESULTS**

**Functional Pathology Laboratories in Africa**

There is wide variability in the availability of pathology providers, availability of services, and caseload. It is apparent that there are huge gaps in adequate service coverage concerning both personnel and utilization. Tables 1 and 2 list the results of the survey that was conducted between August 2011 and July 2014. These results are also summarized as graphs in Figure 1 and can be found online (www.pathologyinafrica.org/data). Table 1 and Figure 1 report the numbers of providers and services available in each country surveyed. As expected, the number of pathology providers in each country is small, with pathologists per population ranging from 9,264.500 persons per pathologist in Niger to 84,133 persons per pathologist in Mauritius. This is in stark contrast to the estimated population per pathologist in the United Kingdom or United States, which is in the range of 15,000 to 20,000 persons per pathologist.7 Clinical services that should be routinely available in all countries were not available in many; immunohistochemistry was available in 16 countries (53% of 30 countries reporting data), and molecular diagnostics were available in two countries (11% of 18 countries reporting data). South Africa is the only country with routine access to immunohistochemistry and molecular testing for the public sector. Table 2 and Figure 2 report the caseloads for small biopsies, large surgeries, fine-needle aspiration (FNA), and gynecologic services including Pap smears. Diagnostic procedures (small biopsies and FNA biopsies) are combined; these tests are used to rule out or diagnose malignancy and to plan therapy such as surgery, chemotherapy, or radiation. We identified statistically significant correlations between the number of providers (Table 1) and caseload.
with $P < .01$ for most correlations between biopsy, surgical, FNA, and gynecologic caseload and number of pathologists, histotechnologists, or cytotechnologists (results not shown). In contrast, the turnaround time was generally inversely correlated with staffing, but the associations were not statistically significant (results not shown).

Similarly (although our data were limited to responses from pathology and not necessarily clinicians), chemotherapy (28 of 32 countries reporting, 88%) and radiation therapy (20 of 32 countries, (Table 2), with $P < .01$ for most correlations between biopsy, surgical, FNA, and gynecologic caseload and number of pathologists, histotechnologists, or cytotechnologists (results not shown). In contrast, the turnaround time was generally inversely correlated with staffing, but the associations were not statistically significant (results not shown).

Similarly (although our data were limited to responses from pathology and not necessarily clinicians), chemotherapy (28 of 32 counties reporting, 88%) and radiation therapy (20 of 32 countries,
Global Strategies to Change Oncologic Care in Africa

The ASAP Group was formed in 2014 at a meeting in Siena, Italy, to address the challenge of generating sustainable pathology capacity in SSA. The ASAP Group created a 5-year strategic plan to achieve the following overarching goal: “Develop a robust framework for efforts to increase and improve pathology services within sub-Saharan Africa.” The two main strategic aims are advocating for pathology and making pathology work. ASAP identified four areas required to achieve these aims. Each of these target areas directly affects oncologic care and will lead to improved outcomes in patients with cancer.

Advocacy. For pathology services in SSA to improve such that superior oncologic care is possible, it is essential to advocate from the patient population, through the health care system, and within the ministries of health for the essential need of pathology and generate the necessary resources to support it.

Infrastructure development. Currently, throughout SSA, there are regions where neither functioning pathology services nor supporting networks for development exist. In other regions, functioning labs have individual aging pathologists with no contingency plan for the future. Still others suffer from broken, non-service-covered equipment or frequent stockouts of needed reagents. Dedication at the governmental level in parallel with external focused support on a case-by-case basis will bridge these gaps and create sustainable, value-based, integrated pathology systems.

Impact data. As was shown in the survey data, many gaps exist in the flow of oncologic care from the pathology perspective. In some of the best cases currently in Africa, one pathologist exists for every 500,000 persons compared with one pathologist per 15,000 to 20,000 persons in the United States and United Kingdom. Without improved pathology services, developing countries in SSA will not be able to respond adequately to the emergence of noncommunicable diseases. To control this, surveillance systems and databases, including tumor registries, need to be set up. Only with real data from individual labs and regions can population-level prevention programs and much needed specific scientific research be accomplished.

Education and training. The lack of qualified pathology staff has severely impacted specimen procurement, turnaround time, diagnostic accuracy, and quality control. Implementation of formal training and education programs is of the utmost importance to improve capacity in this region, create value-based pathology services, and impart sustainability to the discipline.

Local Strategies to Change Oncologic Care in Africa

There are both global strategies to improving pathology capacity for oncologic care across Africa as well as local strategies for improving the care at an individual site. The most important aspect of this latter approach is internal and external assessment of the health care system and level of pathology functionality. To support pathology processes, inputs (clinicians, surgeons, payers) and end users (oncologists, radiation therapy, chemotherapy) must be available to actually effect change in patient outcomes. Complex strategies may be necessary to meet a given region’s needs, as diagramed in Figure 4. In this scenario, capitalizing on technology, focused training, and top-down management can rapidly improve services and affect patient outcomes. This model of oncologic care includes the following components: education of the general population about cancer, prevention, treatment options, diagnosis, and health care infrastructure; community health centers that have direct access to all primary care patients where trained screeners can look for signs of early to late malignancy and determine the next steps for patient care from sampling to palliative referral (also a level at which cytologic samples could be taken [FNA] and sent via telepathology or directly to a referral laboratory or mass screenings, such as breast exams, prostate exams, human papilloma-virus testing, and HIV testing, could be performed and centrally reported); large district or regional health centers that include personnel trained to perform biopsies and with resources to preserve samples
providing optimal treatment, optimal pathology services may not be required. Just as inadequate pathology for diagnosis is a bottleneck in the steps required to improve the level of pathology services. Similarly, of the needs, strengths, and de

components of a functional system. A systematic, formal assessment terms of staff, equipment, reagent flow, training, and other key components of a functional system. A systematic, formal assessment of the needs, strengths, and deficiencies of the situation will identify the steps required to improve the level of pathology services. Similarly, an alignment between pathology and other clinical cancer services is required. Just as inadequate pathology for diagnosis is a bottleneck in providing optimal treatment, optimal pathology services may not be impactful if the ability to treat cancers is inadequate.

CONCLUSION

As in most of the developing world, SSA lacks essential resources to implement safe and effective diagnostic care. Increases in the rates of noncommunicable diseases, especially cancer, in this region are leading to the growing demand for quality pathology services and diagnostic laboratory medicine. Implementation of a sustainable, high-quality system is a necessary action that needs to be taken to address the growing burden on established health care resources. Achievement of the previously outlined strategies will help increase pathology and diagnostic laboratory services. Establishing this framework will help initiate implementing a cost-effective, high-quality, sustainable system that ensures an improved and more sustainable level of care.

REFERENCES


AUTHORS’ DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

Disclosures provided by the authors are available with this article at www.jco.org.

AUTHOR CONTRIBUTIONS

Conception and design: All authors

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Provision of study materials or patients: All authors

Collection and assembly of data: All authors

Data analysis and interpretation: All authors

Manuscript writing: All authors

Final approval of manuscript: All authors

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AUTHORS' DISCLOSURES OF POTENTIAL CONFLICTS OF INTEREST

Oncologic Care and Pathology Resources in Africa: Survey and Recommendations

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No relationship to disclose

Danny A. Milner
Consulting or Advisory Role: Biosciences Solutions Group
Patents, Royalties, Other Intellectual Property: UpToDate

Timothy R. Rebbeck
No relationship to disclose

Yawale Iliyasu
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