

Sustainable Development of Pathology in Sub-Saharan Africa

An Example From Ghana

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• **Context.**—Pathology services are poorly developed in Sub-Saharan Africa. Komfo Anokye Teaching Hospital in Kumasi, Ghana, asked for help from the pathology department of the University Hospital of North Norway, Tromsø.

Objective.—To reestablish surgical pathology and cytology in an African pathology department in which these functions had ceased completely, and to develop the department into a self-supporting unit of good international standard and with the capacity to train new pathologists.

Design.—Medical technologists from Kumasi were trained in histotechnology in Norway, they were returned to Kumasi, and they produced histologic slides that were temporarily sent to Norway for diagnosis. Two Ghanaian doctors received pathology training for 4 years in Norway. Mutual visits by pathologists and technologists from the 2 hospitals were arranged for the introduction of immunohistochemistry and cytology. Pathologists from Norway

visited Kumasi for 1 month each year during 2007–2010. Microscopes and immunohistochemistry equipment were provided from Norway. Other laboratory equipment and a new building were provided by the Ghanaian hospital.

Results.—The Ghanaian hospital had a surgical pathology service from the first project year. At 11 years after the start of the project, the services included autopsy, surgical pathology, cytopathology, frozen sections, and limited use of immunohistochemistry, and the department had 10 residents at different levels of training.

Conclusions.—A Ghanaian pathology department that performed autopsies only was developed into a self-supported department with surgical pathology, cytology, immunohistochemistry, and frozen section service, with an active residency program and the capacity for further development that is independent from assistance abroad.

(*Arch Pathol Lab Med.* 2017;141:1533–1539; doi: 10.5858/arpa.2016-0498-OA)

Pathology services are poorly developed in Sub-Saharan Africa. Most countries have less than 1 pathologist per 1 million inhabitants.^{1–3} This is a particular problem for the treatment of cancer, which is a rapidly increasing health problem in developing countries.^{4,5} To select the appropriate treatment for the individual cancer patient, a precise and complete pathologic diagnosis is required. A pathologic tissue diagnosis is also required to distinguish between cancer and benign lesions. A well-developed pathology service is therefore a key element in a comprehensive cancer program,

to ensure a precise basis for the choice of treatment and to avoid the useless, harmful, and costly use of scarce resources.⁶

A variety of initiatives have been taken to improve the African situation by assistance from developed countries. They include comprehensive plans and recommendations for the development of cancer care, including pathology,^{5,7–9} general strategies for advancing African pathology,^{2,10–13} rotation of volunteer pathologists from developed countries,^{14,15} telepathology with transmission of images to diagnosing pathologists in developed countries,^{16–22} projects concentrating on fine-needle aspiration cytology,^{23–25} and quality control on the performance of African laboratories.²⁶ Many of the articles report on projects after only a few weeks or months of experience. Cancer control plans recommended by the World Health Organization (WHO) have been taken up by some African countries, but funding and implementation have been slow and often have had to give way to other health priorities, such as tuberculosis, acquired immune deficiency syndrome (AIDS), and malaria.⁹ We report here on an 11-year comprehensive plan and partnership between the pathology departments at Komfo Anokye Teaching Hospital (KATH) in Kumasi, Ghana, and the University Hospital of North Norway (UNN) in Tromsø, Norway. The project has been successful and sustainable and could serve as a model for others.

Accepted for publication February 3, 2017.

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The authors have no relevant financial interest in the products or companies described in this article.

This project was financially supported by the governmental Norwegian Agency for Development Cooperation (NORAD), the Komfo Anokye Teaching Hospital (Kumasi, Ghana), and the University Hospital of North Norway (Tromsø, Norway).

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In 2004, KATH opened a new oncology department, and the hospital gained status as a national cancer center for Northern Ghana, an area with 10 million inhabitants. At the time, Ghana had a population of 22 million and only 5 pathologists active in surgical pathology. KATH had a pathology department, but its activity had deteriorated during recent years. As of January 2005, the department had not been able to provide any surgical pathology service for the last year because of a lack of qualified personnel, technical breakdown of laboratory equipment, and low priority in the hospital budget. Reports on specimens sent to outside laboratories took up to 6 months or more. This was particularly problematic for the oncology department, which mostly had to treat its patients without a pathologic diagnosis. With the support of new hospital leadership, the head of the oncology directorate at KATH (Baffour Awuah, MBChB, FCRadOnc[SA], MBA) asked for help when he met the first author at an international conference in January 2005.

PLANNING

The general frame of the project was set by the 3 questions asked initially: Can we send specimens to UNN for diagnosis? Can we send medical technologists for histotechnology training? Can we send 1 or 2 doctors for specialty training in pathology?

Following consultations with UNN staff and management, the first author traveled to Kumasi in June 2005 by invitation from KATH. A 5-year plan aiming for the “rebirth of the pathology department” was worked out through discussions with KATH staff and management. The plan had 3 main phases: First, as an immediate relief of the most urgent need for pathologic diagnoses, UNN offered to receive a limited number of formalin-fixed and wet tissue blocks for processing, slide production, and diagnosis. Second, 2 medical technologists from KATH would train in slide production at UNN for 3 months, return to KATH, and start production of hematoxylin-eosin-stained slides, which would be sent to UNN for diagnosis until diagnostic capacity and competence were established at KATH. Finally, 2 young doctors from KATH would train for the specialty of pathology at UNN for 4 years and then return to KATH to take over reporting of surgical pathology and to start the training of more pathologists.

The introduction of cytology, frozen section diagnosis, and immunohistochemistry at KATH was included in the plan at the end of the project period, when the pathologists-in-training at UNN had returned to KATH. Training of 1 or 2 medical technologists from KATH in cytology screening for 2 to 3 years at UNN was planned to start around the middle of the 5-year project period. During this same period, 2 technologists would be trained in immunohistochemistry. A limited antibody panel with basic equipment for manual staining was part of the plan.

At the time of planning the project, the KATH pathology department had an old separate building, some basic laboratory equipment, a few laboratory technologists, and an elderly pathologist. However, the microtome was broken, the technologists had no experience in running a routine diagnostic laboratory, the single pathologist was heavily loaded with forensic autopsies and teaching in medical school, and the facility was not actively involved in diagnostic services.

PHASE IMPLEMENTATION

Sending Wet Tissue Blocks to UNN

The sending of blocks of formalin-fixed wet tissue to UNN was never realized because of logistic problems. The airlines either refused to transport such material or would only do so at a prohibitively high cost.

Training of KATH Medical Technologists at UNN

Two medical technologists from KATH visited UNN for 3 months in 2005 and participated actively in all procedures of the histology laboratory concerning the production of routinely stained histologic slides. Two medical technologists from KATH visited UNN for 3 weeks in 2010 to train in manual immunohistochemistry. Training was with equipment acquired for KATH and sent there at the end of the training period. At the same time, they also trained to make frozen sections. One medical technologist from KATH visited UNN for 3 months in 2012 for introductory training in cytology screening. The original plan to train 1 or 2 screeners for 2 to 3 years was canceled because of the limited capacity of the UNN cytology section.

Visits of UNN Employees to KATH

One pathologist and 2 bioengineers visited KATH for 2 weeks in 2006 to assist in the restart of slide production. One pathologist visited KATH for 4 weeks each year during 2007–2010. The task was primarily to supervise the autopsy performance of the 2 Ghanaian physicians in specialty training at UNN (see below), and secondly to contribute to surgical pathology reporting. One pathologist and 1 bioengineer visited KATH for 2 weeks in 2011 to assist in the establishment of immunohistochemistry. Two pathologists and 2 bioengineers from UNN visited KATH for 2 weeks in 2014 to assist in the establishment of cytology screening.

Pathology Training at UNN for 2 Doctors From KATH

From March 2006 to March 2010, 2 young Ghanaian physicians trained for the specialty of pathology at UNN, except for autopsies, which they largely did at KATH during 1 month each year, with supervision from UNN. The recognition as a specialist in pathology in Norway is based on the completion of a resident program, including set numbers of postgraduate courses and autopsy, histology, and cytology examinations, and a certification from the training department. Three of the courses include a compulsory test, but there is no specialty board exam. Prior to the arrival of the Ghanaian physicians in Norway, they were presented with a list of premises for their training at UNN:

1. They would have the status of trainees and were not expected to apply for Norwegian medical license or for recognition as pathology specialists in Norway.
2. Because they would not have a Norwegian medical license, they would work under supervision, and all of their reports would be cosigned by a responsible pathologist.
3. They would follow the work schedule and training program of the department’s residents, with some modifications suited to their needs.
4. Main emphasis would be on surgical pathology and cytology, for which they would by the end of the fourth year of training be expected to fulfill the numbers and

types of examinations required for recognition as a specialist in pathology in Norway.

5. The trainees should attend on average 2 Norwegian postgraduate pathology courses per year. The course fees and related travel, board, and lodging would be paid for by UNN.
6. The trainees would be expected to attend a Norwegian language course. The course fee would be paid for by UNN.
7. The requirements for autopsies (200 autopsies including microscopic examination) were assumed to be fulfilled largely or fully by their work in Ghana.
8. At the end of the 4 years of training at UNN, provided they completed the training successfully, the trainees would get a certificate attesting to the fact that they had fulfilled the requirements set for recognition as a specialist in pathology in Norway. It is our understanding that with the addition of a certificate for the autopsy and fifth-year requirements at KATH, this would give the necessary basis for their recognition as specialists in pathology in Ghana.
9. As with all employments at UNN, the first 6 months would be a period of probation, with continued employment dependent on a proper adaptation to the job situation.
10. After the completion of the 4-year training period, the trainees were expected to return to Ghana, and should have had an obligation to do so for a minimum length of time determined by KATH.
11. Each of the trainees would be paid Norwegian kr 200 000 (\$30,800; later increased to Norwegian kr 250 000 [\$37,500]) per year from UNN in equal monthly rates minus income tax deduction and national insurance contribution.
12. The trainees would be covered by national insurance, which includes health insurance.
13. The trainees would each have the offer to rent a hospital-owned 1-room furnished apartment, for which the monthly rent at present is Norwegian kr 4000 (\$600) and includes electricity.
14. The UNN would pay for 1 economy fare, round-trip travel ticket between Tromsø and Kumasi per year for each trainee.

The primary reason why the Ghanaian doctors were not asked to apply for Norwegian medical license was that we felt a strong need to start their training as soon as possible. A license application would take at least several months, require compulsory courses in national subjects, and require a fair knowledge of the Norwegian language. Because they were not expected to work as pathologists in Norway, we also believed that formal Norwegian recognition as specialists would be unnecessary. Finally, the lack of a Norwegian license and specialist recognition would encourage their return to Ghana.

The initial intention was to give priority to learning the Norwegian language during the first few months. However, we soon realized that this would be too much at the expense of pathology training, so they learned enough language to read and understand the clinical information on the pathology request forms and to follow pathology courses given in Norwegian, but were allowed to use the English language in their gross and microscopic descriptions.

The Ghanaian doctors were involved in routine work from the first week of their stay and were given intense

supervision for all their work during the first 2 months. After that, they were included in the general rotation and work schedule of the residents, and they continued to have supervision of their reports throughout the 4 years. Each year they both traveled home to Ghana for a 4-week vacation from the beginning of December, and in continuity with this did autopsies at KATH through January. The reason for fulfilling the autopsy requirement at KATH was the low number of autopsies at UNN. From their salary, the doctors paid income tax, board and lodging, and the national insurance contribution.

Diagnostic Reporting

From March 2006 through 2007, weekly batches of hematoxylin-eosin-stained slides from 10 to 16 cases were sent from KATH to UNN by courier service and were reported by telefax. When needed for immunohistochemistry and other special studies, paraffin blocks were sent to UNN on request. Most cases were reported about 10 days after the slides were sent. Through 2006–2007, a total of 1250 cases were sent to UNN for reporting, of which 337 (27%) were malignant tumors, 287 (23%) were benign tumors, and 626 (50%) were nonneoplastic lesions.

On the initiative of KATH management, the organization Pathologists Overseas¹⁴ established a rotation of pathologists visiting KATH during 2008, 2009, and the first few months of 2010. A newly trained Ghanaian pathologist returned to Kumasi from Accra in 2008, an experienced Ghanaian pathologist joined the department in 2009 after retirement in England, and a third Ghanaian physician returned from pathology training in Germany in 2010. Finally, the 2 doctors trained at UNN took up positions as senior specialists in pathology at KATH in 2010. Thus, after 2008, cases sent to UNN were mainly those for which immunohistochemistry was needed, most frequently breast cancer specimens for hormone receptor assessment.

Facilities, Technical Equipment, and Books

A new pathology building with modern facilities for doctors' offices, a histology laboratory, an autopsy room, a lecture room and a large morgue, provided by the Ghanaian Ministry of Health, was completed in 2007. KATH provided most of the essential new equipment for the histology laboratory, including microtomes, embedding stations, and an automatic staining machine. From the UNN-KATH project, 1 refurbished and 2 new high-quality discussion microscopes, one 6-headed conference microscope, equipment for manual immunohistochemistry, and a collection of minor autopsy equipment were provided. A number of used pathology handbooks were provided from UNN.

Funding

At the start of the project, no funding had been made available. For the first planning visit to Ghana, UNN paid for the travel, and KATH for board and lodging and local transport. For the rest, funding was achieved little by little from the 2 hospitals and as annual grants from the governmental Norwegian Agency for Development Cooperation (NORAD).

KATH provided a new pathology building, new equipment for the histology laboratory, travel expenses for KATH personnel visiting Tromsø, board and lodging and transport within Ghana for UNN personnel visiting Kumasi, weekly sending of slides to UNN, and £16 000 as a contribution to the salary of KATH doctors training at UNN. The doctors

from KATH continued to receive their salaries in Ghana (study leave with pay).

UNN provided about 90% of the salary of KATH doctors training at UNN; board and lodging for KATH medical technologists visiting UNN; free reporting on pathology specimens sent from KATH; leave with pay for UNN personnel visiting Kumasi; travel expenses for UNN personnel visiting Kumasi in 2005, 2011, and 2014; antibodies for the start of immunohistochemistry; 1 refurbished microscope; and books. The UNN contribution to the Ghanaian doctors' salary was made available by keeping 1 resident position vacant.

NORAD provided a total of Norwegian kr 1 040 543 (equal to about \$170 000), covering all travel expenses for KATH doctors training at UNN and for UNN personnel visiting KATH during 2006–2010, specialty training courses and board exam at the Royal College of Pathology in the United Kingdom, 3 microscopes, and some other equipment.

The staff of the UNN pathology department provided all training of KATH personnel and handling of KATH pathology specimens without economic compensation.

KATH PATHOLOGY DEPARTMENT FROM 2010 TO 2016

Upon the return of the 2 pathologists to KATH, diagnostic surgical pathology work resumed in full capacity with local content. Pathologists became integral members of the multidisciplinary tumor board meetings. The services in the department included surgical pathology, cytopathology (fine-needle aspiration cytology and cervix cytology), and frozen sections. The turnaround time for histology samples became 7 days for smaller biopsies and 14 days for larger specimens. The department reported on 5613 biopsies during 2010. The activity of the department has remained at about the same level, with some decline in the total number of biopsies reported. The total number of biopsies reported in 2015 was 3867 and the number of cytology cases was 979, of which 555 were Papanicolaou smears. The total number of autopsies stood at 978, of which 95 were hospital autopsies. The decline in numbers has largely been due to an increase in the number of private laboratory services around the hospital. Immunohistochemistry is routinely done for hormone receptors and Her2 in breast cancer, but there is little use for other markers. Recently, the pharmaceutical company Roche (Basel, Switzerland) has added a phase value to this unit of the department by providing a Ventana (Tucson, Arizona) autostainer. Roche will be responsible for supplies of antibodies and other consumables.

The department gained partial accreditation to train pathologists under the Ghana College of Physicians in 2012. The current number of trainees stands at 6 at the moment, with 4 others waiting to enter training during this training year. The residents will have the opportunity to visit the UNN pathology department for a limited period once during their training period. The first resident to come visited UNN for 3 months in 2016, preparing for his board exam.

RESEARCH AND PUBLICATIONS

A preliminary report from the initial 2 years of the project was published in *Cancer* in 2008.²⁷ During their training period at UNN, the pathology trainees were involved in 2 case reports,^{28,29} 2 comparative studies on malignant and

benign breast lesions in Ghana and Norway,^{30,31} and a study on liver changes in consecutive autopsies at KATH, not yet published.

OPINION POLL

In 2014, an opinion poll was carried out among personnel in both hospitals who were involved with the project. Different versions of a questionnaire were answered by hospital management and the various categories of pathology department staff in the 2 hospitals, according to what was relevant for the respective groups. A few groups gave a collective reply to the questionnaire. Except for hospital and department leaders, the answers were given anonymously. A total of 26 answers from UNN and 5 from KATH were received. The Table shows a summary of the answers from UNN.

The aims and scope of the project were generally seen as appropriate and within the frame of what the hospital should engage in. Some of the pathologists wished they had been more involved in the planning process. The 3-month training practices in histotechnology and cytology at UNN for KATH technologists were rated by most as being effective and useful, whereas some were more reserved about the outcome of the 3-week training in immunohistochemistry. The working stress for UNN personnel in having the trainees in the lab was mostly not a problem, nor was there any significant negative influence on the work environment. Of the medical technologists, only those training in the histology lab contributed significantly to daily routine work. The training of 2 Ghanaian doctors for the specialty was generally seen as very useful and efficient, with little extra working stress on the medical staff and a largely positive influence on the work environment. Their contribution to the routine work was considered to exceed or at least outweigh the time spent on teaching and supervising them. The slides sent to UNN for diagnosis put extra working stress on the department staff, particularly those involved in hormone receptor testing and the secretarial staff. On the other hand, many of the cases were seen as scientifically interesting, and also useful in the training of the Ghanaian doctors. The UNN pathologists and medical technologists who visited KATH all rated their contribution as being very important or important for the project, and their general experience from the visit as being positive or very positive. Remarkably, 24 of 26 UNN respondents said they would likely or very likely support a similar project should it be proposed in the future.

Of KATH employees, the medical director, the 2 doctors trained at UNN, and 2 medical technologists answered the questionnaire. All found the project to be very useful and of an appropriate extent, but some felt they were not involved enough in the planning. The training at UNN, the visits of UNN personnel at KATH, and the equipment provided were all rated as being very important. Asked to estimate the likelihood that the activity of the KATH pathology department would have been at about the same level as it is today if the project had not been established, most respondents held this to be very unlikely or unlikely, with department activity probably mostly comprising autopsies and fewer than 1000 surgical specimens per year, with no immunohistochemistry. For the doctors training for the specialty at UNN, the funding of a round-trip ticket to Ghana each year was seen as very important, and most of the other premises for their training and stay were rated as

Opinion Poll: Summary of Answers From All University Hospital of North Norway (UNN) Personnel Groups^a

Question: To what extent are you satisfied with/positive to each of the following items:	Very Satisfied/Positive	Satisfied/Positive	Neutral/Medium	Mildly Dissatisfied/Negative	Very Dissatisfied/Negative
The aims and scope of the project	17	8		1	
Your involvement in planning of the project		18		5	1
Two Ghanaian medical technologists who had 3 mo of practice in UNN histology lab:					
Efficiency and usefulness	6	4	1		
Working stress on UNN lab personnel		4			
Usefulness for the UNN lab		1	1	2	
Influence on work environment	1	2	1		
Two Ghanaian medical technologists who had 3 wk of practice in UNN immunohistochemistry lab:					
Efficiency and usefulness	3		4		
Working stress on UNN lab personnel	1				
Influence on work environment	1		1		
One Ghanaian medical technologist who had 3 mo of practice in UNN cytology screening lab:					
Efficiency and usefulness	4	5	4		
Working stress on UNN lab personnel	1	3		1	
Usefulness for the UNN lab			4	1	
Influence on work environment	2	2		1	
The 4 y of 2 Ghanaian doctors training for the specialty of pathology at UNN:					
Efficiency and usefulness	14	1			
Working stress on UNN pathology department personnel	9	11	2		
Usefulness for the UNN department	8	11		1	
Influence on work environment	6	11	6	1	
Slides sent to UNN for diagnosis					
Efficiency and usefulness		1			
Working stress on UNN pathology department personnel	4	3		7	
Usefulness for the UNN department		12			
For UNN employees who visited KATH:					
How important was your visit for the project?	4	2			
Your general experience with the visit	5	1			
Your attitude toward similar future projects	9	15	1	1	

Abbreviation: KATH, Komfo Anokye Teaching Hospital.

^a "Don't know" or no answer not included.

being satisfactory. The important exception was the decision that they were not expected to apply for a Norwegian medical license or formal recognition as specialists in pathology in Norway. Although this made it possible for them to start their training earlier, it created certification issues on return to Ghana. If a formal recognition as a specialist in Norway had been allowed, recognition in Ghana would have been automatic. For one of the doctors, the difficulties were circumvented by passing the Royal College exam in London.

DISCUSSION

The project has been successful and has achieved most of its goals. Eleven years after its inception, the KATH pathology department has given full surgical pathology services to the hospital for the past 9 years, has a medical staff of 6 pathologists, is accredited for the training of pathologists, and has 5 residents in the postgraduate program. Immunohistochemistry, fine-needle aspiration, and exfoliative cytology are established. Facilities and technical equipment are modern and of good quality.

Not all of these are direct results of the KATH-UNN cooperation project. However, the project probably created optimism and confidence in a positive development of the pathology department and likely attracted other contributions. The most crucial initial factor was that KATH management and staff realized the importance of pathology

and went out to ask for help. The hospital and the Ghanaian Ministry of Health provided modern new facilities as well as technical equipment for the department, selected the people sent to UNN for training, paid all travel for KATH personnel to Tromsø, and paid for local transport, board, and lodging for UNN personnel visiting Kumasi. There was support from Pathologists Overseas,¹⁴ whose rotating pathologists made an important contribution to the diagnostic activity of the department during the 2 final years before the pathologists trained at UNN could return to KATH.

The early plans for the project were presented to the medical staff of the UNN pathology department in 3 staff meetings during the process, and no objections had been raised. Nevertheless, some of the pathologists felt that they should have been more involved in the planning. A critical point was reached when most of the staff signed a letter to the department management and asked that the invitation to 2 Ghanaian doctors to train for the specialty be withdrawn, out of fear that their training might put an extra workload on an already heavily burdened staff. Similar objections, plus some legal issues, led to the rejection of a similar request for help from a US pathology department.²⁷ In our case, the objections came at a time when funding and work permission for the named trainees had already been obtained, and the process was seen to have come to a point of no return for ethical reasons. With the support of the department management, the objections were overcome by

the project leader promising to handle the greater part of the guidance and supervision during the initial months. As a partly retired senior pathologist, he had the necessary time and capacity to do this, in addition to the confidence that the trainees would contribute substantially to daily routine work. Obviously, this conflict was the background for the less than hearty welcome of the trainees during their first few months in the UNN department. Luckily, their incorporation in the department soon turned for the better as they were seen as hardworking and pleasant staff members whose contribution to the daily workload at least outweighed the efforts spent on their supervision and training.

Brain drain is frequently a problem for building competent environments in developing countries.³² Our project, on the contrary, has seen more of a brain gain effect. One senior medical technologist returned to KATH after having previously left the department for a position in Accra. And 3 Ghanaian pathologists—2 newly trained and 1 who had entered early retirement abroad—took up positions at KATH, as did, later, 2 Nigerian pathologists, in addition to the 2 pathologists trained at UNN. Of the 5 Ghanaian medical technologists that visited UNN for training, only 1 left Ghana, accompanying her husband to the United States.

Health workers overall are strongly guided by their professional conscience and similar aspects related to professional ethos, and nonfinancial incentives play an important role with respect to increasing their motivation.³³ In this respect, the selection of the trainees by KATH management and their obligation to return, the annual paid visits to their home country, the several visits to KATH by UNN consultants and medical technologists, and the provision of high-quality microscopes for the returning pathologists may all have contributed to their motivation to return to the KATH pathology department.

The decision to omit Norwegian medical license and formal Norwegian recognition as pathology specialists probably had both positive and negative consequences. On the positive side, it allowed for an early start of the training without the need to wait for approval and without the uncertain outcome of the application process, and it was to some extent a barrier against nonreturn to Ghana after completion of training. On the negative side, the certificate from the UNN department created issues of certification on return to Ghana and limited progression in Ghana's national postgraduate college. For one of the trainees, this was successfully circumvented by passing the Royal College exam in London. A better approach could have been to recruit the trainees through the Ghana college of postgraduate training or at least work with them to address the issues of recognition as pathologists after their training.

Of the various approaches to enhancing the pathology situation in Sub-Saharan Africa,^{10–13} most have both merits and weaknesses, and sustainable models are crucial.¹

The proposed comprehensive cancer care plans^{5,7,8} are useful as long-term goals, but they may be overwhelming and go far beyond the resources available. Cancer control plans have been recommended by WHO and have been taken up by some African countries, but funding and implementation have been slow and often have had to give way to other health priorities, such as tuberculosis, AIDS, and malaria.⁹

Task-shifting models in which generalists provide advanced cancer care with structured phone or email contact with specialists in developed countries⁸ may not be

sustainable in the long term unless they are supplemented by the establishment of adequate laboratories and the proper education of local personnel. This is also the case for programs of rotating volunteer pathologists from abroad.¹⁴

Telepathology with email or Internet transmission of images of cytology or histology specimens to a diagnosing pathologist abroad has been used successfully for limited periods of time.^{16–20,22} Modern equipment with high-resolution scanning of whole slides gives an excellent basis for remote diagnosis. However, the equipment is expensive and requires competent personnel for maintenance and an accessible pathologist to read the images and make a diagnosis. We consider telepathology to be best suited for situations with a small number of cases, for consultation in problem cases, and for education and training. We agree with Adesina et al¹ that telepathology with external specialists should not be seen as the primary solution for meeting the pathology needs of Sub-Saharan Africa. Instead, in-country capacity must be built to provide for clinical and public health needs.

Fine-needle aspiration cytology is a cheap, simple, and rapid way of pathologic diagnosis.^{23–25} It has the merit of making it possible to undertake clinical examination, aspiration, pathologic diagnosis, and planning of treatment all in one visit, which is often of great advantage in developing countries. It requires a competent cytopathologist, preferably on site, and has weak sides in often leaving a proportion of cases with a diagnosis of suspicious for malignancy but without a definite diagnosis, and material inadequate for diagnosis in a fair proportion of cases. It is therefore most efficient when surgical biopsy is available to clarify cases with uncertain diagnosis or inadequate material for fine-needle aspiration cytology evaluation.

Immunohistochemistry is an important method in modern pathology and is often essential for identifying the precise type of tumor, and thereby for the right choice of treatment. Hormone receptor assessment in breast cancer is in particularly great demand in developing countries, because endocrine treatment is cheap and effective in receptor-positive tumors. However, as discussed elsewhere, quality assurance of the method is essential. Institutions reporting only about 25% of breast cancers as receptor positive may have a large proportion of false-negative results. Selecting patients for endocrine treatment solely on the basis of a receptor assessment method with a large proportion of false-negative results may do more harm than good compared with a practice of giving endocrine treatment to all patients.³⁰

Maintenance and repair of microscopes and laboratory equipment is an issue that was not addressed in our program, but it is obviously an important challenge for KATH to maintain sustainability of the positive development so far.

CONCLUSIONS AND RECOMMENDATIONS

Pathology is a key element in modern hospital medicine, particularly so in cancer care. The different approaches to alleviate the situation in Sub-Saharan Africa should all be welcome, and the best way to start will vary with the local situation and the resources and assistance available. However, sustainable development should always be the long-term goal. That includes the development of pathology departments able to provide diagnostic services at a level comparable to that in developed countries without being

dependent on assistance from abroad, and with formal and real competence to train new pathologists and medical technologists.

A fruitful model can be a bilateral agreement between a receiving (African) hospital or department and a providing (foreign) hospital/department that "adopts" the receiving department. Mediation of contact between departments for this purpose may be a suitable task for organizations like the International Academy of Pathology, the European Society of Pathology, and the American Society of Clinical Pathology.

For the providing institution, a time-limited program ending up with an independently operating pathology department may be more acceptable than diagnostic support unlimited in time. The providing pathology department should appoint as its principal mentor a consultant with sufficient time and commitment to the project. Except for an initial fear of undue extra workload in having the Ghanaian doctors for specialty training at UNN, our project had broad support among UNN staff and management and was highly valued at KATH.

For the receiving institution, a basic condition for successful development is that hospital management and clinical staff members recognize the importance of pathology and be willing to give it due budget priority. In project planning, the priorities and needs of the local hospital staff should be listened to and should be important premises. In planning the education of pathologists, one should secure a good knowledge of the formal requirements of local authorities for full recognition of specialists, including requirements for accreditation to train further specialists. The trainees should be selected by the local hospital and have an obligation to return after they have completed training.

The training of new pathologists should take place with their physical presence and work in a well-developed pathology department. Telecommunication cannot substitute for a close and daily contact with the medical staff of a high-standard department, and should at most be used as a supplement to other training and for consultation on problem cases. The training should have similar programs and requirements for final competence as those in developed countries. After training, pathologists should not be spread out to vulnerable single-pathologist departments, but rather grouped in viable departments with at least 3 pathologists.

Fine-needle aspiration cytology is a rapid, cheap, and technically simple method with high reliability when performed by a well-trained cytopathologist, but it functions best when it can be backed up with surgical pathology to clarify cases with uncertain diagnoses or inadequate material for cytopathology. We therefore recommend that surgical pathology be established before cytopathology.

Immunohistochemistry with a limited panel of antibodies, at least for hormone receptors in breast cancer, should be introduced at a late stage of the project and be subject to careful quality control.

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