

# Improving Anatomic Pathology in Sub-Saharan Africa to Support Cancer Care

Michael L. Wilson, MD,<sup>1,2,3</sup> Stephanie Ayers, MA,<sup>3</sup> Daniel Berney, MB BChir, MA,<sup>3,4</sup> Alexia Eslan, MBA,<sup>3</sup> Jeannette Guarner, MD,<sup>3,5</sup> Susan Lester, MD, PhD,<sup>6,7</sup> Ricard Masia,<sup>7,8</sup> Zahir Mooloo, MD,<sup>3,9,10</sup> Angela Mutuku, MSc,<sup>9,10</sup> Drucilla Roberts, MS, MD,<sup>3,7,8</sup> Jennifer Stall, MD,<sup>7,8</sup> and Shahin Sayed, MMed(Path)<sup>3,9,10</sup>

From the <sup>1</sup>Department of Pathology and Laboratory Services, Denver Health, Denver, CO; <sup>2</sup>Department of Pathology, University of Colorado School of Medicine, Aurora, CO; <sup>3</sup>African Strategies for Advancing Pathology, Denver, CO; <sup>4</sup>Department of Cellular Pathology, Barts Cancer Institute at Queen Mary University of London, London, UK; <sup>5</sup>Department of Pathology and Laboratory Medicine, Emory University School of Medicine, Atlanta, GA; <sup>6</sup>Department of Pathology, Brigham and Women's Hospital, Boston, MA; <sup>7</sup>Department of Pathology, Harvard Medical School, Boston, MA; <sup>8</sup>Department of Pathology, Massachusetts General Hospital, Boston; <sup>9</sup>College of Pathologists of East, Central, and South Africa, Nairobi, Kenya; and <sup>10</sup>Department of Pathology, Aga Khan University Hospital Nairobi, Nairobi, Kenya.

**Key Words:** Global health; Pathology; Cancer care; Education; Training

*Am J Clin Pathol* 2018;00:1–6

DOI: 10.1093/AJCP/AQX158

## ABSTRACT

**Objectives:** Cancer care requires both accurate pathologic diagnosis as well as pathologic cancer staging. We evaluated three approaches to training pathologists in sub-Saharan Africa to perform pathologic cancer staging of breast, cervix, prostate, and colorectal cancers.

**Methods:** One of three training methods was used at each workshop: didactic, case-based testing (CBT), or a blended approach. The project involved 52 participants from 16 pathology departments in 11 countries in East, Central, and Southern Africa. Evaluation of each method included pre- and postworkshop knowledge assessments, online pre- and postworkshop surveys of practice changes at the individual and institutional levels, and selected site visits.

**Results:** While CBT resulted in the highest overall average postassessment individual scores, both CBT and blended approaches resulted in 19% increases in average scores from pre- to postworkshop assessments. Institutions that participated in the blended workshop had increased changes in practice as indicated by the institutional survey.

**Conclusions:** Both CBT and a blended approach are effective methods for training pathologists in pathologic cancer staging. Both are superior to traditional lectures alone.

Accurate diagnosis is key to quality cancer care and to generating much of the data in cancer registries.<sup>1,2</sup> In most sub-Saharan African countries, as in other low- and middle-income countries (LMICs), varying standards of pathology training and the scarcity of a skilled pathology workforce have limited both access to as well as quality of cancer diagnosis and, in particular, the pathologic staging of cancer.<sup>1,2</sup> To help address this gap in cancer diagnosis and staging, access to continuing professional development is a critical need for the anatomic pathology workforce in Eastern, Central, and Southern Africa (ECSA). We describe the findings of Improving Anatomic Pathology Services in Sub-Saharan Africa to Support Cancer Care, a 17-month research project funded by the National Institutes of Health, National Cancer Institute, designed to determine which of three training options was the best approach to enhance the skills of anatomic pathologists to perform pathologic staging of four common cancers.

Common approaches to continuing professional development and skill enhancement include lectures, workshops, online courses, or some combination thereof.<sup>3</sup> These approaches are used by pathology professional societies around the world. On the other hand, formal case-based teaching (CBT) has not been traditionally used in pathology education and training, despite the fact that it is a well-accepted method for adult learning.<sup>4</sup> Although

pathologists, like other medical professionals, have always used cases as examples for teaching, this differs from formal CBT. With CBT, participants are provided with increasingly complex, real-life cases in a structured learning setting that allows them to develop analytical skills. Most CBT includes reading or other resources to help trainees understand the principles being learned. In many cases, CBT is a group activity, which is why CBT is embraced by many medical schools as a way to expose students in a structured way to different concepts they will encounter when they graduate.

To compare approaches for training pathologists in pathologic staging of cancers, in this study, we evaluated three different approaches: traditional lectures, CBT, and a blended approach with short lectures followed by CBT.

## Materials and Methods

The project involved 16 pathology departments in institutions in Zimbabwe, Kenya, Uganda, Tanzania, Zambia, Rwanda, Burundi, Malawi, Madagascar, Mozambique, and Botswana. Up to six pathologists from each pathology department participated in the workshops, for a total of 52 participants. Three of the 16 departments (institutions from Zambia, Tanzania, and Uganda) participated in the first workshop, which featured a didactic teaching style; five institutions (from Zimbabwe, Kenya, Rwanda, and Burundi) participated in the second workshop, which featured CBT; and eight institutions (from Kenya, Tanzania, Malawi, Madagascar, Mozambique, and Botswana) participated in the third workshop, which featured a blended

approach, incorporating both lecture and CBT. These three groups of institutions were matched for similar characteristics as closely as possible. Information on the participating institutions is listed in **Table 1**.

At each workshop, four common cancers (breast, cervix, prostate, and colorectal) were presented. The curriculum was tailored for each of the three approaches as necessary. Members of African Strategies for Advancing Pathology (ASAP); the College of Pathologists of East, Central, and Southern Africa; and Aga Khan University Hospital Nairobi (AKUHN) organized and delivered three 2.5-day training workshops held in January 2016, May 2016, and January 2017. All workshops were held in Nairobi, Kenya. Facilitators for the workshops included AKUHN faculty as well as US and European faculty. The workshops emphasized preanalytic specimen handling processes; analytic processes of specimen grossing, tissue processing, microscopy, appropriate use of ancillary testing, and use of structured format reporting; and postanalytic factors that affect turnaround times and physician satisfaction.

### Workshop 1: Lectures

The lecture workshop was performed using PowerPoint presentations that were created by the US and European faculty. Each faculty member developed a set of three to four lectures for the cancer type that was their area of expertise. The lectures were harmonized in total duration and overall structure. Each faculty member was allotted the same amount of time to present the lectures, with similar amounts of time allotted for questions from participants.

**Table 1**  
Participating Institutions

Workshop	Country	Institution	No. of Participants
Didactic workshop	Tanzania	Muhimbili University of Health and Allied Sciences/Muhimbili National Hospital	5
	Uganda	College of Health Sciences, Makerere University	5
	Zimbabwe	College of Health Sciences, University of Zimbabwe	6
Case-based training workshop	Burundi	University Hospital of Kamenge, Bujumbura	2
	Kenya	Aga Khan University Hospital, Nairobi	5
	Rwanda	Rwanda Military Hospital	1
		University Teaching Hospital of Butare	2
	Zambia	University Teaching Hospital, Lusaka	5
Blended workshop	Botswana	National Health Laboratory	1
		University of Botswana	2
	Kenya	Kenyatta University	2
		Moi Teaching and Referral Hospital	5
	Madagascar	University Teaching Hospital, Antananarivo	4
		SALFA (Health Department of the Lutheran Church)	1
	Malawi	Malawi College of Medicine	3
	Mozambique	Maputo Central Hospital	2
	Tanzania	Aga Khan Hospital, Dar es Salaam	1

## Workshop 2: CBT

Development and testing of cases for the CBT has been published previously.<sup>5</sup> For this workshop, participants were divided into groups of four to six pathologists (groups were of approximately equal numbers) to maximize opportunities for learning and group participation within each group.<sup>6</sup> Groups were given between two and seven cases based directly on information in the corresponding lectures. The same PowerPoint presentations used in the lecture workshop were made available to participants to be used as reference material to answer the questions, but there were no lectures presented. Groups had to independently review the reference material to solve the cases. Participants were given paper copies of the cases so they could answer the questions directly on the paper as they were solving each one. Faculty members were available to answer questions during the sessions. In addition to the faculty members who presented the lectures, additional pathology faculty members who helped create the cases, quizzes, and surveys were present to facilitate with discussions. After each session, the faculty facilitated a summation session where participants could share what they had learned. At the end of the workshop, the cases were collected and scored.

## Workshop 3: Blended Approach

Last, for the blended workshop, each faculty member presented a 30- to 45-minute lecture that emphasized the most important information for solving the cases. These PowerPoint presentations were derived directly from content in the original lectures. Immediately after the condensed lecture, participants were asked to solve the same cases from the CBT as in the second workshop but in a shorter time frame. Faculty members were available to facilitate discussions and answer questions during the sessions. At the end of the workshop, the cases were collected and scored. In a final session, the faculty addressed any questions that were answered incorrectly and also answered any additional questions.

The three workshop styles were designed to be as similar as possible. Each workshop featured the same four faculty pathologists, included the same information in the PowerPoint presentations, allotted the same amount of time for each cancer type, and was held in the same location. Members of ASAP with expertise in educational assessments developed the pre- and postworkshop knowledge assessment, including five questions for each of the cancers. These assessments were administered immediately before and immediately following each workshop to measure knowledge gained by participants. The questions present in the knowledge assessments were the same in the

pre- and postquiz. The results of both sets of pre- and postworkshop assessments were analyzed to determine which teaching approach yielded the best learning outcomes.

This project also determined which of the three approaches was most effective in changing practice patterns at the participating pathology departments within institutions in the ECSA region by comparing the pre- and posttraining results of an online survey tool designed to assess diagnostic capacity at each institution. This survey was administered to the lead pathologist at each institution 2 to 3 weeks prior to the workshops and 8 to 10 weeks after each workshop, with the intention that the pathologists at the institution would work together to complete it.

To validate the accuracy and effectiveness of the online survey tool, site visits to eight participating institutions were conducted 3 months after the completion of each workshop. Pathologists from AKUHN conducted these site visits during May and September 2016 to validate the accuracy and completeness of the postworkshop online surveys. Because the third workshop was held in January 2017, 3 weeks prior to the end of the project, site visits to these institutions were not conducted.

## Results

### Participant Demographics

#### *Lecture/Didactic-Based Workshop*

The didactic workshop included 16 total participants. The participants' years in practice ranged from 1 year to 26 years, with an average of 12.4 years. Of the participants, four (25%) were in the 31- to 40-year age group, five (31%) were in the 41- to 50-year age group, and seven (44%) were older than 50 years. Three (19%) participants were residents, two (13%) were fellows, and eight (50%) were faculty members. Also among the participants were a junior specialist, a consultant histopathologist/forensic pathologist, and a principal histopathologist, all of whom function as pathologists at their respective institutions. Thirty-eight percent of participants were MDs, 44% had master's degrees, and 19% also had a PhD.

#### *Case-Based Workshop*

The case-based workshop included 15 total participants. The participants' years in practice ranged from 1 year to 24 years, with an average of 8.2 years. Of the participants, two (13%) were in the 18- to 30-year age group, nine (60%) were in the 31- to 40-year age group, one (7%) was in the 41- to 50-year age group, and three

(20%) were older than 50 years. Six (40%) participants were residents, two (13%) were consultants, and seven (47%) were faculty members. Thirty-three of participants were MDs, and 53% had master's degrees. One participant has completed fellowship training, and one has an MMed in anatomic pathology.

### Blended Workshop

The blended workshop included 21 total participants. The participants' years in practice ranged from 1 year to 21 years, with an average of 8.6 years. Of these 21 participants, eight (38%) were in the 31- to 40-year age group, nine (43%) were in the 41- to 50-year age group, and four (19%) were older than 50 years. Of the 19 participants who responded to the survey about this workshop, two (11%) were residents, one (5%) was a consultant, and 16 (84%) were faculty members. Of 19 participants who responded, five (26%) were MDs, 12 (63%) had master's degrees, and two (11%) had PhD degrees.

### Participant Assessments

The average percent correct answers on the knowledge quiz for the preworkshop assessment for all methods was 49% to 57%. At the didactic workshop, participants scored an average of 63% on the assessment after the completion of the course, compared to 76% for the CBT workshop and 68% for the blended workshop. The CBT participants scored 13% higher on the postassessment than those who participated in the didactic workshop. The blended workshop participants scored, on average, 5% higher on the postassessment compared with those who participated in the didactic workshop and 8% lower than those who participated in the case-based workshop. However, although the overall postassessment average was highest for CBT, the improvement in scores from the preassessment to the postassessment for both the CBT and blended workshops was 19%. **Table 2** and **Table 3** present participant perceptions regarding clinician concerns toward pathology

**Table 2**  
Concerns Participants Perceived Clinicians Have Regarding Pathology Reports

Characteristic	Perceives Concern, %	Does Not Perceive Concern, %
Turnaround time of reports	96	4
Components not present in report	73	27
Clarity of final result	71	29
Reliance on basic techniques such as cytology or H&E-stained slides only	70	30
Lack of frozen-section capability	59	41
Communication with pathologists	55	45

reports and their own concerns regarding pathology services, which were assessed as part of the preassessment.

**Table 4** presents the average postassessment score for each cancer for each teaching method.

### Institutional Surveys

The institutional surveys assessed resources and institutional practices at each institution, as well as any differences in practices that may have arisen as a result of the workshops. Overall, those variables that exhibited an increase in reporting across all institutions from the preworkshop online survey to the postworkshop online survey were those institutions that do the following:

- Have a tumor board
- Routinely obtain second opinions for new cancer diagnoses
- Have histology laboratory procedure manuals
- Monitor and report ischemic time for breast biopsy specimens
- Monitor and report time of fixation for breast biopsy specimens
- Routinely sample 12 to 15 lymph nodes from resection specimens for colon cancer
- Routinely use structured format reports
- Routinely assign Gleason scores

**Table 5** outlines the percentages of institutions that replied positively to each variable in the preworkshop and postworkshop online surveys, for those variables that showed an increase in institutional reporting from the preworkshop online surveys to the postworkshop online surveys.

### Site Visits

The site visits were conducted to those institutions that participated in the first two workshops and were performed

**Table 3**  
Concerns Participants Have Regarding Pathology Services

Characteristic	Has Concern, %	Does Not Have Concern, %
Lack of access to immunohistochemical stains and molecular diagnostic tests	89	11
Lack of special study capability	88	12
Turnaround time of reports	87	13
Reliance on basic techniques such as cytology or H&E-stained slides only	74	26
Components not present in report	68	32
Lack of frozen-section capability	64	36
Clarity of final result	63	37

**Table 4**  
Knowledge Question Postassessment Scores per Cancer Type

Cancer Type	Didactic Workshop, %	Case-Based Workshop, %	Blended Workshop, %
Colorectal	63	79	70
Prostate	59	69	62
Breast	63	73	71
Cervical	68	73	67

to validate the online survey tools. During the site visits, it was noted that all pathologists and senior residents who participated in the trainings had to some extent instituted structured format reporting for the four cancers covered in the workshops, and in two of the institutions, this change also had been extended to other cancers. Furthermore, educational sessions were held by the participants with colleagues in the department to share knowledge gained and encourage change in practice. Changes in practice were verified by comparing reports that were generated before and after the workshops. Because the site visits confirmed the validity of the online survey tool for the first two groups of institutions, the results of the online survey tool from the third group of institutions are also considered valid.

## Discussion

In general, when surveyed, faculty members felt that the CBT and blended workshops were more effective compared with the lecture-based workshop. The improved performance on the postcourse assessment would support the subjective impression that participants were more enthusiastic and invested while working through the cases. While the CBT workshop was less comprehensive compared with the lecture-based workshop, participants are thought to have learned and retained more information as a result of increased engagement. It is important to consider other variables that could have contributed to the differences in scores. The groups of participants necessarily had to be different for the three workshops, and the differences between these groups, although they were matched for characteristics to the extent possible, could have affected the scores. Thus, it is important to consider the baseline scores from the preassessments when evaluating the results from the workshops.

The successful aspects of the lecture-based workshop, as reported by the faculty, included easier time management, assurance of the uniformity of the educational experience, and the comprehensive and systematic nature of the teaching style. This teaching style provided participants with a core foundation by covering the large amount of information included in the lecture series. However, some participants felt that there might have

**Table 5**  
Institutional Survey Variables With an Increase in Institutional Reporting From the Preworkshop Online Survey to Postworkshop Online Survey

Variable	Preworkshop Survey Average, %	Postworkshop Survey Average, %
Have a tumor board	73	80
Routinely obtain second opinions for new cancer diagnosis	33	47
Have histology laboratory procedure manuals	73	80
Monitor and report ischemic time for breast biopsy specimens	0	27
Monitor and report time of fixation for breast biopsy specimens	0	13
Routinely sample 12 to 15 lymph nodes from resection specimens for colon cancer	33	60
Routinely use structured format reports	40	47
Routinely assign Gleason scores	87	93

been too much information presented in the time allotted, as the material was difficult to condense. In addition, the participants did not have access to the supplementary materials prior to the workshop in order to obtain unbiased preassessment scores; thus, all material was new to the participants during the workshop.

The primary strength of the CBT workshop was the engagement of participants, likely due to the active nature of CBT. It is expected that active learning styles lead to higher retention of the material<sup>7</sup> and to a more positive view of the course and material due to the participants' personal investment in the process. The structure of the workshop allowed participants to focus on those aspects of the material that they were most interested in or had the most difficulty with; this is in contrast to the lecture-based style where faculty members are largely in control of the material covered (with the exception of Q&A sessions). Participants were able to easily reference the materials, and faculty members were available for immediate clarification when questions arose. Because the participants were actively discussing the questions and able to ask questions as they arose, the faculty were able to discern which areas were giving the participants difficulty. Overall, the faculty members noted that participants were more engaged during the CBT workshop compared with the lecture-based workshop.

The strengths of the blended workshop were very similar to that of the CBT workshop. This workshop offered a balance of the lecture-based and CBT styles, providing

participants with the most important information needed to solve the cases. In contrast to the CBT, where some participants seemed lost, this method helped to focus participants on the most pertinent material. Again, participants were able to easily reference the materials and faculty members were available for any needed clarification. The faculty interacted less with the participants throughout the completion of the cases in this workshop than in the CBT, which reduced participant reliance on the faculty and further promoted active learning. Of the three workshop styles, participants seemed the most engaged overall during the blended workshop.

After the completion of the three workshops, a survey was sent to all workshop participants. The purpose of the survey was to explore potential new topics and gauge interest for future workshops. Participants were asked about whether they had shared the materials from the workshop with others, if they made any contacts through participating in the workshops, and if they perceived any changes at their institutions as a result of participating in the workshops. Of the 21 participants who responded, 19 (90%) stated that they had shared the workshop materials with others, including clinicians and other pathologists at their institutions, pathologists at other institutions, and residents. Most (85%) survey respondents reported that they perceive changes at their institutions as a result of participating in the workshops, and 100% of those who responded to the survey reported that they would be interested in attending similar courses in the future. Expanding the courses so that they are held more frequently and cover a wider range of topics was overwhelmingly the most common suggestion provided by course participants. Many participants felt that the course warrants a sustainability plan. Creation of culturally relevant cases for CBT and training African facilitators should be a priority. The workshops were conducted in an African country, and there were facilitators from Africa. Moving forward, the workshops should continue to be based on the African continent and involve African faculty and facilitators. We recommend that the expansion of the model using an approach designed to maximize program reach and minimize costs that incorporates a blended teaching approach be explored. If the faculty were to travel to different locations to hold the course for local pathologists, the course could be conducted using significantly less financial resources. This approach could include local or regional workshops, involving local experts, having online and in-person components, and having an ongoing mentorship program for pathologists and senior residents from LMICs.

Although this project was by design and necessity limited in scope, the findings are similar to other settings where CBT is better accepted compared with a purely lecture-based format.<sup>8</sup> This is not surprising: during training, pathologists are exposed to cases as teaching examples, and cancer diagnosis and staging are centered on individual cases. What is surprising is how long it has taken medical schools, training programs, and professional societies to acknowledge new and better ways of learning. We are not suggesting that lectures should be abandoned altogether, as they are a highly efficient means of communicating large amounts of information quickly (and to a large audience if necessary), but their impact can be improved when combined with CBT in a blended approach. Further experience is needed with this approach and for validation of our findings, but it is increasingly clear that it is time to move pathology learning in new directions.

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*Corresponding author: Michael L. Wilson, MD, Dept of Pathology and Laboratory Services, Mail Code 0224, 777 Bannock St, Denver, CO 80204; michael.wilson@dhsa.org*

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