



## Development of the Medical and Surgical Simulation Institute:

Accra Ghana,  
West Africa

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In 2003, a collaborative relationship was developed between the West African College of Surgeons and the American College of Surgeons to explore what educational programs could be implemented in West Africa. After a series of meetings, the Advanced Trauma Operative Management (ATOM) Course was selected and made available at the Korle Bu Teaching Hospital in Accra, Ghana, in 2005.

The Surgical Skills Training Center was also established in 2005 to provide training in advanced trauma operative management. The name was changed to Medical and Surgical Skills Institute (MSSI) in December 2008. The new name was designed to reflect the expanded functions of the center. The center now trains multiple subspecialties in medicine and surgery, and includes, in addition to the ATOM Course, educational offerings in laparoscopy, anesthesia, orthopaedics, ophthalmology, and other surgical procedures. The center educates surgeons, anesthesiologists, nurses, and technical personnel.

The purpose of this article is to describe the process involved in creating the MSSI, a comprehensive surgical simulation education center in West Africa, which was initiated with the implementation of the American College of Surgeons' ATOM Course.

## The ATOM Course

The ATOM Course was developed by surgeons at the Hartford Hospital, Hartford, CT, and the University of Connecticut, Farmington, in association with the American College of Surgeons' Committee on Trauma.<sup>1</sup> The course material



The surgical faculty at the Korle Bu Teaching Hospital at the University of Ghana with (left to right, front row, beginning second from left) Edward Yeboah, MD, past-president of the West African College of Surgeons; Dr. Jacobs, Dr. Darko; and Dr. Luk.

consists of a CD-ROM and an illustrated textbook that thoroughly describe the operative procedures.<sup>2</sup> The one-day educational experience features six lectures on injuries to various organ systems in the chest and abdomen. These lectures are presented in the morning didactic session. In the afternoon, there is an operative experience in a formal operating room environment, where 12 standardized injuries are created in a 50 kg swine, and students are presented with five clinical scenarios. The students are required to develop appropriate treatment plans, identify the injuries, and effectively manage and repair the injuries operatively. The injuries include trauma to the bowel, bladder, ureter, kidney, duodenum, pancreas, liver, stomach, spleen, diaphragm, inferior vena cava, and heart.

The course, including the evaluation methods, is grounded in educational theory and has been standardized to ensure its consistent replication.<sup>3-5</sup> Evaluation of students includes pre- and

post-assessments of knowledge and self-efficacy. Knowledge of ATOM and self-efficacy for ATOM have been documented to improve from pre- to post-ATOM.<sup>1,6</sup>

ATOM participants from across the world have responded overwhelmingly positively to two surveys that assessed their perceptions of the value and quality of the course.<sup>7,8</sup> However, when establishing the course in a country that has not previously been a site for ATOM, the teaching methods need to be reviewed and evaluated to ensure that they are culturally appropriate. In West Africa, medical education has been influenced by a number of inherently different training paradigms. Surgeons in West Africa may have been trained in programs based upon African, British, Belgian, French, or American educational systems. When the ATOM course was introduced in West Africa, the following questions were evaluated:

- Will the CD-ROM, textbook, lecture format, and style of presentation be conducive to the students' learning needs?
- Will the structure of the laboratory experience conform to students' expectations and behaviors?
- Are there cultural aspects of the teacher/student relationship that need to be considered?
- Will the student evaluation instruments reflect true quantities of knowledge and self-efficacy, and not variance due to cultural or linguistic differences?

## **A simulation education center in West Africa**

### **Preliminary decisions**

In order to implement the ATOM Course in West Africa, a number of decisions needed to be made to move the project forward. First, an international agency that was skilled in developing complex projects in Africa needed to be identified. This agency would bring the technical skill and assistance necessary to implement the project. International Aid was selected for this role. Next, a teaching hospital and a university setting had to be identified, preferably locations that included a veterinary laboratory with the capabilities to operate on live animals. The facility needed several modern and complete operating suites with

**Table 1.**

### **Challenges to developing a surgical simulation education center in an international location**

- Learn unfamiliar customs and requirements to initiate the project
- Involve of all stakeholders
- Locate an appropriate physical site that replicates an operating room
- Provide a veterinary facility
- Allow equipment to be brought into the country
- Transport equipment to the center
- Locate technical staff to maintain equipment

sterilization capabilities, and equipment including anesthesia, operating tables, operative lights, and surgical instruments. Korle Bu Teaching Hospital in Accra, Ghana was chosen as the site, and Rudolph Darko, MD, FWACS (co-author of this article), was named as the principal investigator of the program. Finally, a funding agency needed to be recruited that understood the immediate short-term and long-term implications of a project of this magnitude; Johnson & Johnson graciously accepted this responsibility.

### **Visionary leadership and goal setting**

The visionary leadership at the Korle Bu Teaching Hospital recognized the potential for a major educational center that would not only teach surgery for penetrating trauma to surgeons, but would continue to develop into a site that could bring other operative education, including laparoscopy, minimally invasive surgery, ophthalmologic procedures, and other surgeries, to the region. They envisioned that this educational site would train anesthesiologists, operating room nurses, technologists, and technical personnel needed for a complete and realistic surgical experience. Furthermore, the center would be embedded with the professional leadership that would sustain it for many years, in order to foster its growth and development as a major educational resource for West Africa, and as part of an international network of educational facilities. An ongoing goal is that the center becomes approved as an accredited educational institute of the American College of Surgeons.

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### Collaborative planning

Having clarified the vision to bring the ATOM Course to West Africa and develop a comprehensive education center there, a number of partners were involved in extensive planning discussions. These included the leadership of the American College of Surgeons, the West African College of Surgeons, the University of Ghana, the government of Ghana, Johnson & Johnson, and International Aid. Faculty from the University of Connecticut and Hartford Hospital became the proponents of the project. Having developed the ATOM Course at Hartford Hospital and having participated in

the initial collaboration between the West African College of Surgeons and the American College of Surgeons, the faculty knew what needed to be accomplished in order to bring the ATOM Course to West Africa, and to initiate a comprehensive simulation education center there.

These partners delineated the scope of the task and identified the technical and financial hurdles that had to be overcome. These challenges included the medical-political interaction of two international colleges of surgeons and the coordination of the interactions of the government of Ghana, the Ministry of Health, and the Prime Minister's office, as well as Johnson & Johnson and International Aid (see Table 1, page 25). All the permissions to conduct the course needed to be obtained from the government of Ghana and the University of Ghana.

Once there was agreement that this was a worthy project and that the financial and political hurdles could be overcome, it was critical to have the surgical leadership at the Korle Bu Teaching Hospital travel to Hartford Hospital to take the ATOM Course, in order to understand the details involved in implementing the course in Ghana. A number of surgeons from the West African College of Surgeons came to Hartford Hospital and successfully completed the course. The principal investigator of the Simulation



Anesthesiologists training in the Simulation Center.

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Center worked closely with the veterinary laboratory and equipment personnel to be sure that the operating room equipment and instruments could be completely reproduced in the center in Ghana.

### Securing funding

The financial requirements to establish, sustain, and grow a comprehensive center were significant. The director of Johnson & Johnson's corporate contributions met with the leadership of the West African College of Surgeons, the American College of Surgeons, and the University of Ghana in order to stay informed of the goals of the project and the financial requirements to create a simulated operating suite. Johnson & Johnson agreed to provide substantial financial assistance for the project.

### Securing equipment

Once the financial support was secured, it was essential to involve an organization that had moved, implemented, and maintained complex medical equipment in other geographic locations. International Aid had worked closely with Johnson & Johnson on several projects and had the appropriate professional and technical assistance to support the project. They were able to procure the necessary surgical and an-



Left to right: Dr. Jacobs, Dr. Darko, and Dr. Yeboah.

the various support services such as anesthesia, scrub nurses, and technical assistants, are needed, so that the students envision themselves in a real operating room. Because the center would use a live porcine model, there had to be a fully approved veterinary facility on site. There needed to be the space to house and anesthetize the animals and a way to transport them to the operating room.

### **Implementation of the ATOM course**

The planning and development process, which took more than a year, culminated in the inaugural ATOM Course at the Simulation Center at the Korle Bu Teaching Hospital in Accra, Ghana in February of 2005.<sup>9</sup> It

esthesis equipment and transport it from the U.S. to West Africa. Once there, an experienced technical team from International Aid worked with the local personnel to assure that all the equipment would function flawlessly in the simulation education center. A major consideration was the compatibility of the equipment with the electrical supply. With the help of the team from International Aid, the local personnel became experts at troubleshooting and maintaining the anesthesia and surgical equipment.

### **Securing a facility**

An effective architectural plan for the center was critical to ensure the success of the project. Since the center was envisioned to grow over time to include new and different technical innovations, the ability to expand the center was necessary. Classrooms and computer access to the Internet for multiple students were required. Additionally, the culture of the center needed to support educational theory that mandates that simulation be in a setting that is as similar as possible to the real practice environment. The visual and auditory cues, as well as the correct placement of the equipment and the location of

was offered in West Africa in the same format, with the same objectives, content, and teaching strategies that had been implemented in the U.S.

Several courses were given with a team from the American College of Surgeons. The team included Lenworth Jacobs, MD, FACS (co-author of this article); Stephen Luk, MD, FACS; Edward Cornwell, MD, FACS; Samuel Adebajo, MD, FACS; Peter Ekeh, MD, FACS; Fiemu Nwariaku, MD, FACS; and William Dyckman, a veterinary specialist from Hartford Hospital who assisted the local team with anesthetizing and preparing the swine. Conrad Person, director, Johnson & Johnson corporate contributions, and Myles Fish, chief executive officer, International Aid, observed the course. The technical expertise of the support team provided by International Aid was essential to ensure that four operative cases could be conducted simultaneously. This meant that 48 procedures were performed within four hours in the Simulation Center. This is a significant challenge for any major teaching hospital. Not only was this successfully carried out during the inaugural course, but the operations were performed on two consecutive days.

**Table 2.**

Actions to facilitate development of a surgical simulation education center in an international location

- Recruit leadership of respected organizations to clarify the vision
- Educate all stakeholders on the vision
- Establish a commitment from all stakeholders
- Engage in collaborative planning
- Secure funding and identify sources of continued support
- Secure an appropriate physical site
- Recruit experienced technical personnel
- Demonstrate training of instructors
- Demonstrate potential of the center by successfully implementing a course

**Table 3.**

Number of ATOM participants in West Africa, by country, 2005–2009

Ghana	33
Nigeria	22
Ivory Coast	2
Sierra Leone	2
Senegal	1
Gabon	3
Malawi	1
Kenya	1
Ethiopia	1
Zambia	1
Uganda	1
Niger	3
Total participants:	71

The evaluative component of the course required that students complete Web-based pre- and post-course assessments. The computer interface allowed the students to take the pre- and post-tests electronically, allowing the instructors to immediately identify the pre-course knowledge and self-efficacy of each student. This information was extremely important to objectively quantify the level of preparation and receptiveness of the students. The pre-course scores were consistent with other students who had taken the course elsewhere in the U.S. and Canada. Following the completion of the course, the students were required to take a multiple-choice examination and complete a self-efficacy questionnaire. These evaluations were also completed immediately following the operative laboratory portion of the course. The instructors were able to review the results of the examinations prior to the students leaving the center. The electronic database was essential in providing immediate feedback for the students—which is key, as a number of these surgeons had come from other countries. The students were appreciative of the objective and subjective evaluation of their performance prior to their returning to their home states or countries.

The department of anesthesia, under the leadership of Henry Baddoo, MD, at the University of Ghana Medical School and Korle Bu Teach-

ing Hospital, recognized the educational benefit of the ATOM Course for anesthesiologists. Dr. Baddoo, in association with Dr. Jacobs and Mr. Dyckman, the veterinary specialist, developed an education curriculum for practitioners who would be providing anesthesia for the swine.

The curriculum included knowledge of specific details of porcine anesthesia, the appropriate doses of anesthetic agents, the appropriate volume per kilogram settings for the anesthesia machines, and the technical details of porcine intubation, as well as arterial and venous cervical surgical exposure and cannulation of the porcine anatomy.

Four separate teams were utilized to sedate, anesthetize, and prepare each of the four animals. A significant component of the educational program was to maintain meticulous records of the weight, size, volume, and dosage of medications and crystalloid infusions, as well as of the physiological responses to the operative interventions during the course. These records were carefully analyzed following the completion of the course. The results of the research were presented in the *Ghana Medical Journal*.<sup>10</sup> This document has become an important adjunct to any educational site that will be conducting an ATOM Course.

A number of nurses were attendant at each course, and were able to assist in the operative management and instrument preparation and se-

**Table 4.**  
Training offered at the MSSI

- Advanced Trauma Operative Management
- Basic surgical skills
- Anastomoses workshops
- Fundamental laparoscopic surgery
- Flap plastic surgery
- Orthopaedics–joint replacement
- Ophthalmology
- Anesthesia technology
- Lymphatic filariasis
- Laboratory technology chemical analysis
- Nursing
  - Wound management
  - Infection control
  - Time and ward management
  - Ophthalmic nursing
  - Pre- and postoperative care
  - Ethical and legal issues in nursing

**Table 5.**  
Institutions collaborating with the MSSI to offer accredited education

West African College of Surgeons, *Lagos, Nigeria*  
 American College of Surgeons, *Chicago, IL*  
 Hartford Hospital/University of Connecticut, *Hartford, CT*  
 The Royal College of Surgeons of England, *London, UK*  
 The Royal College of Surgeons of Edinburgh, *Edinburgh, UK*  
 University of Michigan, *Ann Arbor, MI*  
 University of Strasbourg, *Strasbourg, France*  
 University of Toronto, *Toronto, ON*  
 University of Tübingen, *Tübingen, Germany*  
 The Society of American Gastrointestinal Endoscopic Surgeons, *Los Angeles, CA*

lection for procedures in the abdomen and chest. There was also an opportunity to become facile with the preparation and loading of numerous stapling devices. Similarly, there was significant benefit derived from the preparation of instruments and selection of suture equipment for major injuries to the liver, inferior vena cava, and heart. The first-hand observation and involvement in managing these major procedures in a real, but controlled, environment were found to be extremely beneficial to the operating room nursing and technical staff.

Conducting the ATOM Course was a noteworthy event for the West African College of Surgeons, and was attended by the leadership of Korle Bu Teaching Hospital and the medical school, as well as by a number of officers of the West Africa College of Surgeons. The President of Ghana, the leadership of the Ministry of Education, and the Ministry of Tourism formally recognized the importance of this educational activity at a reception at the Office of the President.


### **A commitment to state-of-the-art education**

The success of the ATOM Course reinforced the institution’s commitment to develop a comprehensive surgical simulation education center

at the Korle Bu Teaching Hospital. However, this commitment needed to be endorsed by all stakeholders in the project. This required a substantial initiative by the leadership of the West African College of Surgeons, and involved developing relationships with the Minister of Health, the Prime Minister’s office, and with members of the U.S. embassy. In addition, the support of the administration of the University of Ghana, including the dean of the medical school and the administrative and clinical staff of Korle Bu Teaching Hospital, needed to be secured. To all stakeholders, the center was highlighted as a significant enhancement to the health care of the citizens and visitors to Ghana and the surrounding countries in West Africa. (The development of the MSSI in Accra Ghana, West Africa is summarized in Table 2, page 28.)

### **Benefits to the local team**

Since the inception of the ATOM Course in Ghana in 2005, 71 surgeons from 12 countries in Africa have taken the course (Table 3, page 28). The MSSI has become a central location for training surgeons, anesthesiologists, ophthalmologists, nurses, and technical personnel. It has become a forum for practicing techniques, training professionals in new procedures, provid-

ing didactic lectures, and evaluating the results of the educational process. To satisfy the demand for certified courses, the MSSSI has provided a platform for universities, professional associations, nongovernmental organizations, and corporations to provide affordable in-country medical training. Medical professionals from 13 African countries have taken courses at the MSSSI. Table 4 on page 29 lists the educational topics that have been presented at the MSSSI. These offerings have created strong academic links with major international institutions. Video conferencing is now available at the MSSSI through connections with the University of Michigan, Ann Arbor; the Royal College of Surgeons of England; and the Royal College of Surgeons of Edinburgh. Table 5 on page 29 presents the institutions that have collaborated with the MSSSI to deliver accredited programs. 

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