STUDY ABROAD: ADVANCING HEALTH CARE IN RWANDA

Just like that, Dustin Ritter knew he was where he was supposed to be.

Some 8,500 miles from home and working in the neonatal intensive care unit of the largest hospital in the African nation of Rwanda, the biomedical engineering graduate student from Texas A&M University was struck with an acute sense of purpose after hearing a doctor's story.

Ritter, who was participating in his department's first study abroad program in Rwanda, had been assigned to the hospital to help repair medical devices as part of the program's curriculum. It was his first day on the job, and he was eager to get started. Joined by his wife, Sarah, also a graduate student in the program, Dustin surveyed his new environment, wondering if the couple could truly make a difference in the month they would be working in the hospital.

Having a vigorous interest in global health initiatives, the couple had made the trip to serve as teaching assistants in the program while gaining a more tangible perspective on the health care obstacles facing developing countries such as Rwanda.

That perspective was instantly brought into keen focus for the Ritters when a doctor from Human Resources for Health (HRH) who was working in the unit happened to notice the young couple and, striking up a conversation, learned they were biomedical engineers on hand to help repair the unit's medical equipment. He was overjoyed. His next few sentences told the reason why.

Dustin Ritter was part of a study abroad group that repaired 112 pieces of medical equipment, valued at $225,000.

It had been only days ago, the doctor said, when a newborn in the unit had died tragically after its assisted breathing device ran out of oxygen without any hospital staff knowing. The device's sensors and alarms were not properly functioning, so no one was alerted, and the baby ultimately suffocated.

In short, there was plenty of work to be done – critical work, and Dustin and Sarah were badly needed.

"I think that created a sense of urgency for us for the rest of the time we were there," Dustin said. "That really drove home the impact of what we were doing. That death didn't have to happen, but it did because the country is not yet where it wants to be in terms of health services; it's trying but it needs assistance."

It may be an overstatement to label these types of events as commonplace, but, at the very least, they are not surprising in Rwanda. Despite making impressive gains in health care in recent years, the country is still facing significant obstacles due to limited resources. Those obstacles, as the Ritters learned, can quickly translate into tragedy. It's a harsh reality of the region that's difficult to accept, and it underscores a critical need for the assistance Dustin and Sarah, along with 11 of their fellow engineering students are providing through an intensive two-month study abroad program aimed at improving health care in Rwanda.

The program is sponsored by Texas A&M's Department of Biomedical Engineering and Engineering World Health (EWH), a nonprofit organization dedicated to improving the quality of health care in hospitals serving resource-poor communities of the developing world. Known as the EWH-Texas A&M Summer Institute, the new program brings engineering students to Rwanda for a two-month period so that they can work with local hospital staff to repair medical equipment and train personnel while experiencing the culture and conditions of a developing region.

As part of the program, students live in the homes of local families, receive instruction in the local languages – French and Kinyarwanda – and attend biomedical engineering classes instructed by Texas A&M faculty members.

Dustin and Sarah were part of the inaugural study abroad class in Rwanda, which included seven undergraduate students from Texas A&M and four other students – from Boise State University, Purdue University, Rochester Institute of Technology and Washington and Lee University.

With the guidance of their faculty instructor, Charles H. and Bettye Barclay Professor and Department Head Gerard Coté, as well as biomedical equipment technicians trained by EWH, the students went to work, visiting hospitals and repairing the damaged medical equipment they encountered. Sometimes the tasks were as simple as replacing a blown fuse. Other times, students found themselves deciphering schematics, replacing circuit boards and reinstalling software for equipment such as anesthesia machines, oxygen plants and x-ray devices.

"My confidence grew after working on my first piece of equipment," recalled Ibukunoluwa Oni, a biomedical engineering major from Texas A&M. "We repaired a wide variety of equipment. Sometimes we only had to solidify a loose connection, but we also worked on more complex devices like infant incubators that needed their heating elements replaced."

In addition to repairing devices, the students often times took on the role of teacher, devoting time to train local hospital staff in the proper use of their newly functioning medical equipment – a measure, the students explained, intended to decrease user errors and ensure the devices remain accurate and functional.

"It was a neat experience to push some of the [local] personnel towards the medical equipment we were working on and show them what they should be doing with it," said Mason Coté, an undergraduate biomedical engineering major from Texas A&M.

In total, the 13 students repaired 112 pieces of equipment, valued at $225,000, across six hospitals throughout Rwanda, said Kristen Maitland, program coordinator and associate professor in Texas A&M's Department of Biomedical Engineering.

Beyond the obvious and immediate benefits provided to Rwanda health care facilities and their patients, the department's study abroad program provides potential long-term solutions by tasking its students, upon returning to their universities, to draw on their experiences in order to design new medical devices capable of meeting the specific needs of a developing country.

"The design aspect of the program is an essential element," Gerard Coté said. "It provides the students that were actually in country with an experiential opportunity to work with local staff, doctors, and nurses, toward engineering low-cost, high-quality, solutions to their challenging clinical issues."

Students in the program submit official design proposals for medical devices, Coté said, that can be further explored by the department's senior-level design teams and the "AggiE-Challenge" program, a college-level initiative through which undergraduate engineering students form multidisciplinary teams and tackle design projects related to engineering challenges throughout the world.

With the information provided by the Rwanda study abroad experience, senior design students as well as AggiE-Challenge participants have the opportunity to develop prototypes of medical devices that can be taken back to Rwanda for testing by future study abroad classes, Maitland says.

The result, Dustin Ritter says, will be a more effectively designed device that's suited for the conditions of the region.

"You have to be in touch with the actual user of the device," Dustin said. "If you designed something for a developed country such as the U.S. and then tried to give it to a developing country where there is intermittent water and electricity, it won't work. You have to design for what you have available to you, what is locally available.

"You shouldn't design a device that needs an obscure battery or a really obscure custom part. Design for what that region has and what it can easily obtain. You also have to consider the environment. For example, if you design a device for use in a place that has very high temperatures and humidity and no air conditioning, you're going to have to seal everything up or design something that is not susceptible to rust. Aspiring, young engineers might not even be thinking about these constraints without experiencing the region firsthand, like we did through the program."

Given the initial success of the program, department and EWH officials are hoping to expand it next year, enabling nearly twice as many students to participate and work in 12 hospitals throughout Rwanda. It's a win-win situation for the students, who receive invaluable, hands-on experience applying their knowledge to real-world engineering problems, and for Rwanda as it continues a dramatic advancement in health care reform.

Since experiencing a devastating genocide in 1994 that killed nearly one million people, Rwanda has committed to rebuilding, particularly in the area of health care. Statistics from the World Health Organization show Rwanda's life expectancy has doubled, and the country has registered significant decreases in deaths caused by HIV, tuberculosis and malaria. Citing the creation of universal health insurance, a national network of community health workers, and key collaborations that have led to new facilities such as Rwanda's first cancer center, The New York Times labeled Rwanda's health gains as "the most dramatic the world has seen in the last 50 years."

It's an extraordinary reinvention for the war-torn region, but one that's still a work in progress – and one that needs programs like the department's study abroad experience and people like the Ritters.

"With global health, you can make such a tangible difference; There is so much need, but you can't do it by yourself," Dustin said. "It takes several components, everyone working together – and we've now seen that firsthand.

"Sometimes it can be depressing, but I also feel like there are things that can be done. I still want to be involved; I still want to try and do more. I want to try and help by taking some of these concepts developed by our students, other students in other programs and others who aren't in any programs – and find a way to manufacture them and get them out there to these people who need them."

Experience the Ritters' journey to Rwanda in their own words. Visit rittersinrwanda.wordpress.com or scan this QR code with your smart device.

MRI-Guided Brain Surgery Technology Goes Global

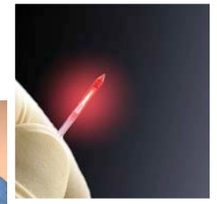
An MRI-guided laser system that allows surgeons to perform brain surgery on tumors and epileptic lesions in the brain is expected to become widely available to patients in need now that the technology has been acquired from Visualase Inc. by the global medical device company Medtronic, Inc., says a biomedical engineering professor from Texas A&M University who co-founded the company responsible for the technology.

The technology, says Gerard Coté, professor in the university's Department of Biomedical Engineering and director of the Center for Remote Healthcare Technology, enables surgeons to pinpoint and destroy brain tumors and lesions with extreme precision and is a much less-invasive alternative to conventional surgery.

The advantage of this approach over other approaches for brain surgery, Coté explains, is that it can be performed while the patient is awake, requires no radiation and no skull flap (the large opening in traditional craniotomies), and is often performed in otherwise inoperable areas of the brain.

Traditional brain surgery, he explains, is usually a daylong operation that involves removing part of the skull, cutting through healthy brain matter and physically removing the problematic tissue. That procedure, he adds, can be followed by a weeklong hospital stay and prolonged recovery period.

The technology developed by former Texas A&M students Ashok Gowda and the late Roger McNichols, conversely, can be completed in about four hours, and most patients can return home the following day, Coté says.



Known as "Visualase," the technology is already used in more than 45 hospitals, nationwide, including 15 pediatric hospitals. Before the surgical procedure, computer software first helps identify the targeted tissue so that it may be treated and the surrounding healthy tissue can be avoided, Coté explains.

During the procedure, a small entry is made in the skull that allows a laser applicator (about the size of a pencil lead) to be inserted into the tissue. The patient is placed in the MRI, and a physician receives and reviews images to verify proper positioning of the laser applicator in the skull. The clinician then uses a laser to heat and destroy the problematic tissue while imaging the tissue being damaged in real time to ensure destruction of the problematic tissue and to avoid damaging healthy tissue. The laser applicator is then removed, and the scalp is closed with one stitch, Coté notes.

Medtronic's acquisition of Visualase, Inc. (the privately held company co-founded by Coté and his colleagues Gowda, McNichols, and Sohi Rastegar, former Texas A&M Professor) means Medtronic will add the MRI-guided laser ablation system to its portfolio of therapies for treating neurological conditions and will integrate the technology into its broader neuroscience offerings.

"My colleagues and I are very excited about this acquisition and I truly believe it will provide more global access to this innovative technology that will ultimately help many more patients undergoing brain surgery for neurological conditions," Coté said.

The all-cash transaction of up to $105 million includes an initial payment of $70 million plus additional payments of up to $35 million that are contingent upon the achievement of specific milestones, reads a release issued by Medtronic.

Learn about the process. Scan this QR code with your smart device.