



On the **Front Lines** *in* **Sierra Leone**

TULANE DOCTORS AND RESEARCHERS SCRAMBLE TO TREAT PATIENTS AND STEM THE TIDE OF THE DEADLY EBOLA VIRUS IN WEST AFRICA.

By Barri Bronston and Sarah Netter

Suited Up

Dr. Susan McLellan on the ground in Sierra Leone, wearing her PPE, or personal protective equipment.



Serving Sierra Leone

Part of curbing the spread of Ebola is investigating who a patient may have had contact with.

Kenema is a quiet town, skirting the edge of the rainforest in southeastern Sierra Leone.

Diamond trading posts dot the main city. Motorbikes beep as they bump across bad roads—some paved, some dirt. In the villages just outside town, extended families of 10 to 15 people rest under thatched roofs. Most people live on less than \$1 a day.

The world's eyes are now on this coastal West African country ravaged by the worst Ebola outbreak in history. But to a handful of scientists, doctors and researchers from Tulane University, Sierra Leone is a second home.

And unlike so many other doctors and researchers who rushed into West Africa to fight the Ebola outbreak, the team from Tulane was already there. Ebola came to them.

FEVER CONSORTIUM

"It's a small, little quiet town, Kenema is," said Robert Garry, professor of microbiology and immunology at Tulane University. "The people are extraordinarily nice people. They're wonderful people. They're hard-working. They've been through a lot. They don't have a lot."

For the past 10 years, Tulane has been a principal player in the Viral Hemorrhagic Fever Consortium based out of Kenema, a city of more than 125,000 people. Since 2004, researchers from the consortium have been immersed in the study of Lassa fever, which has striking similarities to Ebola, though not as deadly.

Last spring, as the Ebola virus started to pick up steam in neighboring Guinea, Garry, a principal investigator for the consortium, and Lina Moses, an epidemiologist and Tulane's field sites manager for the Lassa fever program, were at work in Sierra Leone along with their consortium partners from Harvard University and Sierra Leone's Ministry of Health.

"We knew immediately once there were cases showing up in Guinea that our team was at high risk," Garry said. "I mean, the outbreak really started just a three or four hours' drive from where we had been working."

And when Ebola crossed the border into Sierra Leone, it was the team already in Kenema that the government turned to for help. The small isolation unit in the 350-bed Kenema Government Hospital was the only place in the region that was equipped to handle hemorrhagic fever patients.

But, it was not nearly large enough to handle what would come next.



RAPID RESPONSE

Garry was back in the United States for Memorial Day weekend, attending a wedding of a family friend, when he got a cellphone call from Sierra Leone. The first case of Ebola had been diagnosed there. He was on a plane within days, taking with him all the personal protective equipment he could carry.

Moses, who had been in Sierra Leone since February, had gone home in early May to Louisiana for a three-week break to see her husband and her two young daughters.

She had been back in the United States for two days when she got her phone call that Sierra Leone had its first case of Ebola. She immediately got back on the plane and stayed for another four months.

"On the ground we were really overwhelmed," said Moses, her voice cracking.

The Viral Hemorrhagic Fever Consortium had typically treated five Lassa fever patients per week at the height of a virus season. In those first four weeks of the Ebola outbreak, they recorded 106 Ebola cases.

"We were in over our heads very, very early," Moses said. "And it was apparent it was going to get bad or have the potential to get bad."

It was a sense of dread that would prove sickeningly accurate in the months to come.

'DO YOU THINK THEY NEED ME?'

In those first six weeks of the Ebola outbreak in Sierra Leone, the Viral Hemorrhagic Fever Consortium team was largely on its own. The World Health Organization was running out of funding from its efforts to control the spread of Ebola in Guinea and Liberia, where workers in those countries believed, for a time, they would get the upper hand.

But in Kenema, the virus was only spreading.

"All activities related to Lassa completely shut down for me and my teams," Moses said.

Clinicians—most of them doctors and nurses from Sierra Leone who had worked with the consortium for years—began early data gathering on the first Sierra Leonean Ebola patients, taking temperature readings and vital signs as well as more complicated monitoring of liver enzymes.

It is extremely unusual for researchers to be in a position to be so hands-on in those first early days of an outbreak, Garry said, and all the data collected in those first weeks is now being used to better diagnose Ebola and understand how it's transmitted.

"We were able to do a lot of things that had never been possible before," Garry said.

Moses trekked to the eastern district of Kailahun with her team,



Medicine and Humanity

Left: Lina Moses, an epidemiologist, meets with families in Sierra Leone.

Right: Dr. John Schieffelin preps for another long day at the hospital.

"This is a deadly scary disease, and we haven't seen the full impact of it yet."

**—Dr. Robert Garry
professor of microbiology
and immunology
at Tulane University**

trying to trace patients' contact with others. Who had they visited? Where did they live? Who did they know that had been sick?

Moses and her colleagues were met with hostility from the Kailahun villagers, who often held a deep mistrust toward Westerners and had heard rumors that Ebola wasn't even real. Roads were blocked, cars smashed.

"Our teams had rocks and stones and sticks thrown at them," Moses said.

By mid-summer, WHO had moved into Sierra Leone, and Kenema Government Hospital had transformed into a full-blown Ebola ward. Two Tulane University infectious disease specialists headed to Kenema—Dr. John Schieffelin, clinical director of the Viral Hemorrhagic Fever Consortium, and Dr. Daniel Bausch, associate professor of tropical medicine in the Tulane School of Public Health and Tropical Medicine.

"It was like a three-ring circus," Schieffelin said. "You'd have a lot of healthy people with minimal symptoms wandering around, and you'd have confused, symptomatic people wandering around. They'd all be mixing together, and it was very scary."

While they are living in Kenema, the team from Tulane University stays in a five-bedroom house with the luxury of running water—cold only—and flushing toilets. They get electricity from a generator for a few hours in the evenings.

Back in New Orleans, Dr. Susan McLellan, an infectious disease and tropical medicine specialist at Tulane, was getting the itch.

"Do you think they need me?" she asked Schieffelin and Bausch, both friends she had worked with before.

By then, Schieffelin was on the ground in Sierra Leone. He and Bausch were consulting for WHO, which had just announced it was scaling up efforts to battle Ebola in West Africa.

Initially, the answer was 'no.' So McLellan and her family headed to Highlands, North Carolina, for an already scheduled summer vacation. One day after they arrived, she learned through an email from WHO that her services were needed after all.

"My first response was, 'What have I done?'" she said. "I was anxious before I left. I had trouble sleeping."

With the resigned blessing of her husband and two teenage children—they knew this is just what she does—she returned home to New Orleans and made all the necessary arrangements, among them a mandatory physical and an online security exam. WHO found her a flight and got her to Sierra Leone within days. Before she knew it, McLellan was smack in the middle of the outbreak.

RISING EPIDEMIC

The number of cases in West Africa skyrocketed startlingly fast. Within months those first few hundred cases turned into thousands. And by November, there were more than 10,000 cases of Ebola.

Ebola began seeping into other countries—Nigeria, Senegal, Spain. In September, the United States reported its first case, an African man traveling from Liberia to Dallas, Texas. He died on Oct. 8, infecting two nurses who had cared for him.

With the number of cases rising by the day, the Centers for Disease Control and Prevention said the virus could potentially infect 1.4 million people just in Liberia and Sierra Leone by the end of January.

"This is a deadly scary disease, and we haven't seen the full impact of it yet," Garry said. "It's a battle that is going to be difficult to win."

Ebola spreads through contact with bodily fluids of people who have been infected with or died from the virus. Patients typically exhibit sudden onset of fever, intense weakness, muscle pain, headache and sore throat, followed by vomiting, diarrhea, rash, impaired kidney and liver function, and in some cases, both internal and external bleeding, according to WHO.

There is no known cure, and 70 percent of patients who get the virus will die.

'ALARM BELLS ARE RINGING'

Tulane doctors, working on the WHO team, rotated in and out of Kenema, providing direct care but jeopardizing their own health and safety in the process.

"It was always a concern, even though we were wearing the protective equipment," said Schieffelin. "But once in a while there would be some sort of wardrobe malfunction—something not connected right, a tear in a glove, which meant that the integrity of your protection was broken and you needed to leave (the patient wards) immediately."

Schieffelin stayed for about three weeks, shuffling between a ward for patients suspected of having the disease and a ward for those who tested positive.

"We would get entire families, as many as 12 people, in the ward at one time," he said.

More often than not, patients died. Nothing hit McLellan harder than the death of 6-year-old girl who lost both of her parents to Ebola.

"I just watched her get weaker and weaker, and then she died, alone in her bed," McLellan said. "It's a profoundly comfortless disease from which to die because no one will dare touch you or hold you. No one touched that little girl."

The fear of touching took a psychological toll on patients and staff alike.

"Nobody touches anybody," said McLellan. "No one was taking chances—even though this is not the way you're getting Ebola. I remember one time putting my hand on a nurse's shoulder, and she flinched and said, 'Don't touch me.'"

When McLellan came home in August, one of the first things she said to her husband was, "Give me a hug."

The Tulane team was hit especially hard by the loss of healthcare workers they had known for years from their work in the Viral Hemorrhagic Fever Consortium. They included Dr. Sheik Humarr Khan, who was considered a national hero in the fight against Ebola, and chief nurse Mbalu Fonnies.

"These weren't just random healthcare workers who died. These were doctors and nurses whom we had worked with for 10 years or more," Bausch said. "We do our part flying in and out to help but they are the real heroes."

TESTING PROMISE

After just a few weeks home in Louisiana this fall, Schieffelin and Moses headed back to Sierra Leone in November, this time to start clinical trials on a new rapid response test that would give doctors an Ebola diagnosis in a matter of minutes versus days.

Working like a glucose monitoring device, the test involves pricking the patient's finger—requiring less blood and less invasive interaction with the patient than the current syringe and vial test.

McLellan was also headed back to Africa, but to nonaffected countries, such as Chad, Equatorial Guinea and Cameroon to work on preparedness.

While the international medical community is now fired up about containing the outbreak, Garry said he wished this type of vigilance and commitment could have come months earlier.

"A lot of people have died," he said. "A lot of people I cared about have died."

Bausch, too, expects to return but is devoting much of his time to consulting with WHO. He recently traveled to WHO headquarters in Geneva, Switzerland, to work on strategies that he hopes will bring Ebola under control for good.

"We want to see how we can move things along with experimental therapies and vaccines," he said. "The alarm bells are ringing. But we're still so far from the end of this." 🇺🇸

—Colleagues Lost—



Dr. Sheik Humarr Khan

had been working with the Viral Hemorrhagic Fever Consortium for a decade and was a top doctor for the region, serving as the physician-in-charge at Kenema Government Hospital.

Khan, a 39-year-old soccer fan, had been on the front lines of the Lassa fever project and knew the risks of hemorrhagic fevers, but was in the Ebola wards from the start of the outbreak. He contracted the disease while treating patients and died in July.

Khan and four other healthcare workers were among 50 co-authors of an Ebola study published in the journal Science in late August after they had died. In the study, the scientists were able to show how rapidly the virus mutated as the outbreak spread.

Khan's death was especially hard on his consortium colleagues from Tulane University who had worked side by side with Khan for many years.

"He was an absolutely great guy," said Robert Garry, a principal investigator with the Viral Hemorrhagic Fever Consortium, describing Khan as "a very easy guy to get along with."



Alex Moigboi

was a nurse at Kenema Government Hospital and "the backbone of the clinical team," said Lina Moses, the field sites manager for the Viral Hemorrhagic Fever Consortium. "He worked tirelessly."

Moses said the nursing staff was afraid of Ebola and afraid of contracting the illness, but kept going back, over and over, day in and day out, knowing they were the only people trained to help.

Moigboi died from Ebola in the second week of July, leaving behind children and a family.

"When Alex died it was a huge blow. A huge blow to the nursing staff. Dr. Khan was distraught," Moses said.

Serious and studious, Moigboi was often found taking notes by patients' bedsides. Those notes would later prove critical to research conducted about the virus.

"He always wanted to learn more," Moses said.



In the Lab

Dr. Robert Garry has been working on a rapid diagnostic test that would diagnose Ebola in minutes.

