

My Experience Helping a New Laboratory in Guinea West Africa



Joel E. Mortensen, Ph.D. FAAM, HCLD, AHI (AMT)

I am Dr. Joel Mortensen, the Director of the Diagnostic Infectious Diseases Testing Laboratory at Cincinnati Children's Hospital, in Cincinnati Ohio. I trained at The Ohio State University and Baylor College of Medicine. This is part of my professional story.

The Journey Begins

In 2020, during the time of CoVID, I received an email that had been sent to a group of Directors of Microbiology Laboratories from around the world. The email was sent by Dr. Chris Doern on behalf of two colleagues that he had helped train in the medical school in Dallas, TX. They were asking for help with several positions at a clinic that they were building in Guinea, West Africa. One of these positions was a clinical microbiologist. Response was a bit limited because of the need to spend several months a year in Guinea, the expense of travel to Guinea, and the need for "old school" expertise with basic microbiology and parasitology. Before I responded I headed to Google to look up Guinea.

- Guinea is on the west coast of Africa and facing the Atlantic Ocean. It is bordered by Guinea-Bissau, Senegal, Mali, Côte d'Ivoire (Ivory Coast), Liberia and Sierra Leone.
- Guinea is sometimes called Guinea-Conakry because of several other countries in Africa with Guinea in their name. Conakry is the capitol city.
- The country is one of the larger producers of the bauxite in the world.
- Additional exports include gold, diamonds, iron, oil, and other minerals.
- Over 20 languages are spoken in Guinea and are focused in tribal areas. The common language is French.
- French occupation of the region began in 1890. Guinea declared independence in 1958.
- The current regime is headed by the military following a coupe in the fall of 2021.
- Guinea was one of several West African countries involved in the Ebola outbreak in 2014.

While learning about Guinea, I found a few disturbing facts about healthcare in general, and pediatrics in particular, in Guinea. Mortality in children under 5 years is 96/ 1000, compared to 6/1,000 in the USA and 1.9/1,000 in Iceland. Neonatal mortality in Guinea is 62/1000 live births. Malaria is the primary cause of death (14.2%) in all age groups and a particular problem with children. The prevalence of diarrhea is 12.4% in children aged 0-59 months and

cholera has been endemic in the country since 2003. In Guinea, 31% of children are chronically malnourished and 14% are severely malnourished. This health care crisis is compounded by respiratory tract infections such as tuberculosis, and emerging and re-emerging diseases. ^{1,2}

I started an email dialogue with the founders of Sacre Coeur Pediatric Hospital. Sacre Coeur is a part of Hope Ignited, a non-profit charity with Adam and Rachel Jamison, MD, serving as Executive Director (Adam) and Medical Director (Rachel) of the center. Rachel is a board-certified pediatric cardiologist. They are supported by Courtney Baldrige, MD, a pediatrician and Aaron Baldrige, an educator. The two families have worked together since they moved to Paris several years ago to learn the French language. Following the year in France, both families moved to Guinea.

During CoVID, travel was limited and my responsibilities at Cincinnati Children's Hospital were all consuming, but as the pandemic quieted, I began to think about how I could best contribute to providing high quality microbiology in this resource limited setting. Although weekly calls were good, I needed a better understanding of what is really needed and what is really possible given the severely limited resources in Guinea. Construction plans for the housing units, the chapel and the hospital were finalized and construction began to develop the new pediatric health care center. The leadership team at Sacre Coeur also began to interview personnel for nursing, the pharmacy, the laboratory and local physicians. In 2022 it was time for me to go onsite and contribute to training of newly hired laboratory technologists and help refine the plans for the future of the laboratory services needed to support the hospital.

Getting ready to travel to West Africa was an event in and of itself. A current passport and entry visa into Guinea was reasonably easily accomplished. The visit to the travel clinic resulted in many vaccinations and discussions about CoVID, malaria, dengue, Ebola, diarrhea, mosquitoes and more. Soon enough I was ready to make the flight. I was lucky and only needed two flights; Cincinnati to de Gaulle Airport in Paris and de Gaulle to Conakry, Guinea. Each flight was about 8 hours long with 4 hours layover.

Guinea

Arriving at night, I did not fully appreciate the beauty, majesty, and abject poverty of the area - not to mention the incredible heat and humidity. The hospital and housing at Sacre Coeur consisted of four apartments - one for each of the families, Jamison's and Baldrige's; one that was shared by the Head Nurse, Pharmacist, Outreach Specialists and grade schoolteacher and a guest house. I was assigned to the guest house. It was bright and airy with a large living room/dining room, a kitchen and powder room, laundry room, along with a master bedroom and bath, and two bedrooms with a shared bathroom. All the rooms had fans and built-in air-conditioning units. Of course, air-conditioning requires electricity, but more on that later. The two-floor hospital had cement walls, tile floors, high ceiling and air conditioning units and were bright and clean throughout. There was space for examination rooms, radiology, pharmacy, laboratory, offices and meeting rooms. In addition, there was a large chapel beginning to take shape. Lots of workman and trucks gave the site a sense of energy and anticipation.

For me, the first step was to visit several laboratories in the capitol city to evaluate the current standard of care. The Sacre Coeur Pediatric Center is located just North of Conakry in a small town called Dubreka. It was about 25 miles to first of the Laboratories that our laboratory team was



Figure 1. Sacre Coeur Hospital.

going to visit but because of the rough roads and slow and snarled traffic, we planned on a 2 ½ to 3 hours drive! During the day, we visited several laboratories, the first was new and bright at Centre de diagnostic de la CNSS Caisse. It had modern diagnostic equipment at a high level of sophistication. In microbiology, they had plated media (shipped in from France) and bioMerieux blood culture and identification and susceptibility testing platforms. Information seemed to be captured electronically, although ledgers seemed to be everywhere. Utilization of the equipment in microbiology was limited seemingly by the cost of importing the supplies. This large hospital only had 1 blood culture bottle in the incubator at the time we were there. I was told that the cost of a blood culture was equivalent to \$50.00 US, pricing it beyond most patient's ability to pay.

The other sites that we visited were one room laboratories with simple bench top hematology and chemistry analyzers, and a microscope. Microbiology testing was limited to malaria smears and the direct examination of stool for parasites. Record keeping consisted of two large paper ledgers one for patient information and one for results. Patients were most often supplied with handwritten results in a small book that the patient carried with them from physician to physician. The smallest laboratory used a collection of home style glucose metering devices and a microscope. There, the technologists reused the slides and coverslips, and dried slides on the glass panels of the open window. The ceiling fan and single light bulb combined with the 95°F and 98% humidity created working conditions beyond anything I had experienced. Although the microscope had a light bulb, the technologists talked about needing to use their microscopes by the window reflecting the sunlight through the microscope mirror. Everyone seemed dedicated to their patients but with the exception of the first clinic, the terribly limited resources were striking, especially compared to my home laboratory at Cincinnati Children's Hospital.

Back at the Clinic, I began training the technologists. All the technologists had worked at other laboratories in the area, have college level education and are fluent in French. We started with "How to Wash our Hands" and what to wear in a laboratory (shoes were the biggest issue). The technologists know the basics; however, this was a chance to reinforce the basics, build from the ground up and create a shared culture. Then we moved on to basic

laboratory safety and personal protective equipment such as lab coats, gloves, goggles, and how to don and doff these items. The routine that we settled into was: discuss, observe, perform. As each person performed each basic task, they described what they were doing.

The next several days were spent balancing lectures and wet laboratory training. The first challenge was finding the space for the training laboratory and lecture space. Construction in the laboratory at the hospital was moving along but was not complete, so we adjusted by converting the living room and kitchen in my apartment to a laboratory and classroom space. I lectured in the living room, and we had teaching labs in the kitchen. We used a plastic wash pan for stain waste with an oven rack to hold the slides. The new Nikon microscope had a camera and is the most advanced scope they have ever seen. At night I adapted lectures that I brought with me from my Medical Laboratory Science teaching series to meet the needs of the clinic, and to match the knowledge and experience of the technologists. The entire process was a bit slow because I do not speak French and they do not speak English, so I had a translator with me all the time. Over the next 5 days we balanced general clinic orientation and microbiology lectures and labs including: Laboratory safety, Review of basic microscopy, the theory and application of the Giemsa and Gram stains, and basic direct stool microscopy. In addition, we covered the taxonomy, history, disease and laboratory identification of malaria, trematodes, nematodes and cestodes. All four technologists had been “taught” to identify malaria in the laboratory but they had little understanding of the life cycles or epidemiology of the infection. But all of them have had malaria. During one lecture session I was discussing systemic worms and one of the technologists called out that she had been infected as child with a worm that would emerge from her foot and her mother would try to grab it!



Figure 2. The Laboratory team in Guinea. The four technologists are holding their certifications for training. Dr. Rachel Jamison is the Medical Director of Sacre Coeur (third from left) and Dr. Joel Mortensen (fifth from left).

Daily Life

It is hard to adequately describe the impact of the weather on daily life. I was there in the beginning of November 2022. This was the beginning of the dry season so there was almost no rain and every day was sunny, hot (95 - 98°F) and humid (98 - 100%). Everything was green and plants grew everywhere - walls, walkways, drainage ditches, everywhere. There weren't many insects during my time there. I put mosquito repellent on every morning. Although early morning and dusk were times to watch out for mosquitoes. I had no problems with them.

Two other daily challenges were water and power, with power being an endless trial. Although my apartment had air conditioning, there was no power for four hours most every day. Other times, two dozen small voltage regulators struggled to balance out the continuously fluctuating city power or backup generators. The backup generators required constant attention and drank endless liters of gasoline. Cold showers were refreshing, but sometimes a little too refreshing. Water was usually available from a water tank in the compound, although without electricity the pumps didn't run. Water was filtered before consumption. The system of large filters in each apartment made filtering water easy.

I like to cook and enjoy good diverse food. However, I quickly found that the main staple in Guinea is rice with brown sauce. The sauce may contain chicken or fish or peanuts. There are certainly fruits and vegetables as well, but rice and sauce were the usual fare. Most evening meals were kindly provided by one of the family groups living at the center. Dinner was often American style food with a group "pizza and a movie" on Friday night. The families were all incredibly kind and inclusive.

My time in Guinea came to end much too quickly. The Medical Director and I gave each of the four technologists a training certificate for the 40 hours of contact time that they spent learning basic parasitology. I gave each of them my WhatsApp account and my email.

The 20 miles and two-and-a-half-hour trip back to the airport was punctuated by countless massive potholes, snarled traffic, and demands for bribes from the police and the military. The flight home on AirFrance was surreal compared to my experiences in the last two weeks. The champagne was chilled perfectly. The grilled vegetables and risotto were wonderful. There were two red and two white wines from which to choose. The baguette was warm and had just the right crunch. I reclined my seat/bed and tried to sleep. I wish someone had warned me how hard it was to reintegrate back into "normal" society. The resources and opportunities that I had taken for granted for years now screamed of excess and entitlement.

Home again

In two weeks, what had I learned? There were lots of lessons, but I came away with several key concepts for setting up a microbiology laboratory in a resource limited setting.

- Don't accept limitations - adapt.
 - Processes
 - Resources
 - Procedures

- Match the methods to the resources.
- Donations are wonderful but sustainability is the key.
- Long term commitment to the institution by foreign teaching/support staff.
- Develop the staff.

In addition to these concepts, I needed ongoing processes to keep the momentum and the reach these goals. To that end, we have set up weekly Zoom calls. There is always the cancelled calls due to lack of power or other crisis, but we are doing well. I am introducing the laboratory team and the rest of Sacre Coeur hospital leadership to what standard Policies and Procedures look like, and how to write them.

I have been trying to determine how to get basic quality control material for parasitology and bacteriology to the laboratory because there is no functional post office in the country. I took Gram-stain control slides and old CAP blood film slides with me. Stool parasite control material has been more of a challenge. I purchased several stool specimens in formalin with known intestinal parasites - 2 ml each (Tropical Biologicals). I had them shipped from Puerto Rico, USA to my house. Then I shipped them to Hope Ignited offices in Argyle Texas. Hope Ignited can find people travelling to Guinea to carry supplies in their luggage to Sacre Coeur.

The lectures are ongoing, and I have found some basic microbiology instructional material in French on YouTube. When I work with the team in Guinea over Zoom now, I make all my slides in English and French. Google translate isn't perfect, but it is usually adequate.

Policies and Procedures

<ul style="list-style-type: none"> • Policy – what we intend to do and why. <ul style="list-style-type: none"> • Who • What • Where • When • Procedure – how will perform tasks. <ul style="list-style-type: none"> • Step 1 • Step 2 • Step 3 	<ul style="list-style-type: none"> • Politique – ce que nous avons l'intention de faire et pourquoi. <ul style="list-style-type: none"> • Qui • Quoi • Où • Lorsque • Procédure - comment effectuera les tâches. <ul style="list-style-type: none"> • Étape 1 • Étape 2 • Étape 3
---	--



Figure 3. An example of a presentation slide in English and French

We use WhatsApp for communication. It seems to keep functioning no matter what and allows me to receive text on my computer and have Google translate it quickly. Below is a recent text from the two physicians at Sacre Coeur sent a couple of weeks after I returned.

Update - WhatsApp

- [12:52 PM, 12/13/2022] Dr. Courtney:
 - Dr. Joel, I just wanted to share with you that we today had our first positive malaria smear when I read the results with PERCENT PARACETEMIA! Esther got a laugh out of my excitement. It's the first time I've ever had a malaria smear result with a percent parasitemia reposted! Many thanks to you, the trainer, and to our great biologists who were willing to learn a new method!
- [12:54 PM, 12/13/2022] Dr. Rachel Jamison:
Thank you Dr. Joel!!! 🙌

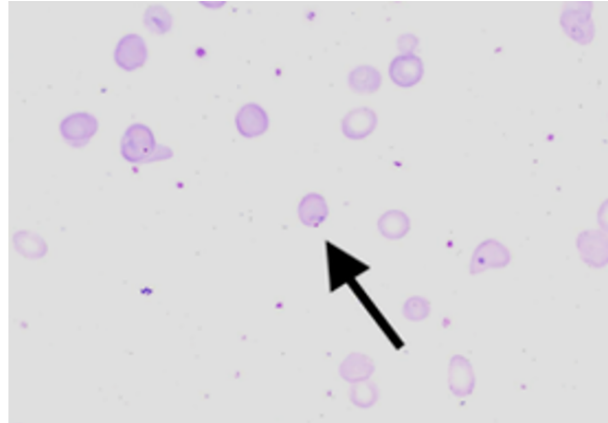


Figure 3. A recent WhatsApp text from the team in Guinea.

The week after that text, a small number of routine patients were seen at the hospital. One day, of the first 5 patients sent to the lab (still in the living room of the apartment!) for testing, 3 were positive for malaria, 2 *Plasmodium falciparum* and 1 *Plasmodium malariae*. The next day had 2 patients with malaria and one with *Hymenolepis nana*.

What is Next?

Together with the medical and laboratory staff at Sacre Coeur, the journey to bring state-of-the-art laboratory medicine to a resource limited setting has just begun. I will be going back.

References

1. USAID Country Dashboard - Guinea [Internet] USAID [Cited January 13, 2023] available from: <https://idea.usaid.gov/cd/guinea/>
2. UNICEF Data: Monitoring the situation of children and women - Guinea [internet] UNICEF [Cited January 13, 2023] available from: <https://data.unicef.org>