

CDC Ebola Response Oral History Project

The Reminiscences of

Jordan W. Tappero

David J. Sencer CDC Museum

Centers for Disease Control and Prevention

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Jordan W. Tappero

Interviewed by Samuel Robson
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Interview 3 of 4

CDC Ebola Response Oral History Project

Q: This again is Sam Robson here with Dr. Jordan Tappero. Today is now—

Tappero: Thirty-first.

Q: Yeah, December 31st, last day of 2015. We're in the CDC [Centers for Disease Control and Prevention] Roybal Campus, Clifton Campus. It's our third interview now as part of the Ebola Responders Oral History project. In our last interview I think we ended with Dr. Tappero talking about becoming director of the Division of Global Health Protection within CGH [Center for Global Health] and participating in the GHSA [Global Health Security Agenda] demonstration in Uganda. The first thing we thought we would talk about today is the mechanics of how the US got involved in the Ebola response in West Africa because Dr. Tappero is pretty eloquent and straightforward about how that all took place.

Tappero: So I think if we could look back through the retrospectoscope and see that this outbreak in West Africa had its first laboratory confirmed case in December of 2013, but that wasn't known to CDC. It wasn't known to anyone. That was done with testing of a specimen many months later. But what we really should have seen was that in January

and February of 2014 that there were clusters of deaths among healthcare workers and in communities in the Forest Region of Guinea, and that Forest Region is sort of a landlocked area that wraps over the top of Sierra Leone and Liberia and it's sort of a border area as well with those two countries. As those first cases started to occur in late 2013 and early 2014, the absence of the surveillance systems for reportable disease or absence of surveillance systems for syndromes such as clusters of deaths among healthcare workers, the kind of things that should be in a reportable surveillance system for all ministries of health around the world, there just wasn't such a system. So as the epidemic started to spread, there was no visibility or reporting to the national level. I think that in January and February some concern of this possibility was out there and the World Health Organization's regional office, the AFRO [African Regional Office], had some awareness that there was something going on there but with the revision of the International Health Regulations in 2005, the responsibility for declaring a Public Health Emergency of International Concern resides with World Health Organization's headquarters. So the headquarters office has to work with the regional offices around the world about public health threats and every country has a point of contact under the International Health Regulations for reporting diseases of concern to their regional WHO [World Health Organization] office.

At some point in January or February, AFRO knew that there was something going on, but they felt that they had had experience with the Ebola epidemics and they weren't asking for assistance from headquarters, etcetera. And then finally WHO, in the waning days of March of 2014, it was the 26th or 27th, announced that there was a laboratory-

confirmed Ebola outbreak in West Africa in Guinea, Liberia and Sierra Leone, and the laboratory confirmation for that was done by sending a test specimen to one of the Pasteur Institute laboratories in Senegal that actually confirmed that there was Ebola. So what was boiling in the background clearly was an Ebola outbreak and there were I think delays in responding to that appropriately.

Anyway, once WHO made that declaration that there was an Ebola outbreak in West Africa in late March, CDC—as it often is—was asked to deploy and participate in the response, and we did, and we had people in Guinea I think as early as April 1st or the last day or so of March, early first week of April. I think it was a team of four to six people that went out in the beginning. The typical response to an Ebola outbreak with identifying, ensuring that cases of Ebola or suspected cases of Ebola were isolated and received care. But what wasn't clear to those early teams was how long the outbreak had preceded, going back to at least December of 2013, and because there was no reportable disease surveillance, where the outbreak was perceived to be was where the teams went. But what was really happening was that there were people that were infected and then moved on in this very porous border area forested region, remote dense rainforest area where it's hard to have visibility on things especially if there's no reportable disease surveillance system, and little hot spots were happening all over this remote forested rural area.

So in late March early April, the response went forward, went well. We clearly had an increasing number of people deployed. WHO had more people deployed. Médecins Sans

Frontières, or MSF, as it typically does, provides that niche of clinical service delivery where they have their prepackaged tented structures that serve as Ebola treatment units, and they sent their clinical staff to man these pop-up facilities, if you will, and started providing care in Lofa County in Liberia for example and then the Forest Region of Guinea and even in the border areas with Sierra Leone. So you started to see the typical Ebola response with CDC, WHO, MSF, a handful of other international deployers responding, and by May or so it looked like where there were cases that people knew about, there was the typical control of doing the contact tracing around the contacts of confirmed cases. If they came ill, isolate them quickly; if they're not ill and they pass a twenty-one-day incubation period, then they no longer need to be followed because they were exposed but not infected. So that went well and by the end of May or so I think people thought maybe this outbreak is over. I think there were a handful of people that the international response knew had been on contact lists but that were lost follow up. You can't, unless people are quarantined, lock people up and put them under confinement. You need their participation to be followed for twenty-one days. There was one such case that we knew of, made his way down to the capital in Monrovia and got on a motorcycle and disappeared. But it was not known that he was infected, just an exposed case or contact.

Anyway, as things started to wind down end of May and early June, it looked like things were going in the right direction. Then in the middle of June, late June, despite our encouragement to MSF to keep their ETUs [Ebola treatment units] in remote areas in place—you never know. You need to go out two incubation periods with no reported

cases anywhere of forty-two days. And so preparations were still in place with the partners to remain vigilant, but the nascent aspect of surveillance is what was really crippling. Where there was disease in these remote areas, it wasn't being reported, so we didn't know if it wasn't reported. Ministries didn't know if it wasn't reported. And then all of a sudden in June there were hot spots identified, and by late June it was becoming quite concerning that there were even cases being reported to show up in more populated areas, such that in early July, Dr. Frieden activated our Emergency Operations Center for this Ebola outbreak. During the month of July we started deploying more senior people and having an increasing presence. By the end of July, however, all three countries had had cases being reported in their capital cities, and this was quite an alarming finding. These cities are densely populated urban slums, overcrowding; lack of water, electricity, clean water, chlorinated water. Healthcare facilities were starting to see Ebola. They didn't have the proper personal protective equipment to manage Ebola. Such that by the first week of August, WHO—with much encouragement from the international partners—finally declared a Public Health Emergency of International Concern at the headquarters level, and that gave WHO the authority under the International Health Regulations to send headquarters expertise to the field even if the regional office was saying that they didn't need assistance. So WHO's presence started to arrive.

At the same time, I think this was August the 7th if I remember the date correctly—could be off a day or so—we also had the three US embassies in Guinea, Liberia and Sierra Leone, in working with the ambassadors with the senior government officials in those three countries, declare disaster declarations. So disaster declarations were declared and

under US government law, when a disaster declaration is declared, USAID's [United States Agency for International Development] Office of Foreign Disaster Assistance, or OFDA, is the lead for that kind of disaster declaration. Now typically, in fact historically and in all previous episodes of a disaster declaration, these have been related to hurricanes, earthquakes, tsunamis, major floods, volcanic eruptions. Those kind of more natural disasters. Sometimes civil unrest and displacement of people like what's happening in Syria would be another explanation for a disaster declaration that OFDA would be the US government lead in. But there had never been a disaster declaration for Ebola that resulted in Office of Foreign Disaster Assistance, so this was a new area for CDC and for OFDA.

Normally, and as had happened in this outbreak, CDC had bilateral invitations from Liberia, we had deployments through WHO for Guinea, Sierra Leone, we were clearly in all three countries and expanding the number of people from six to fifteen or so, starting to see the magnitude of this epidemic in late June and through the month of July. But with the disaster declarations and the Public Health Emergency of International Concern declaration by WHO, we had to find how the US government would work in this environment. There were a lot of discussions between Dr. [Thomas R.] Frieden, myself, Michael Gerber, and our OFDA counterparts about what this niche would look like with the legal authority being with OFDA and the foreign deployment of a Disaster Assistance Response Team or a DART under OFDA. So what was agreed to would be that CDC would be the technical lead and there would be a public health and medical response lead for the DART, and I was that first person to be the public health and medical response

team lead across the three countries. So I departed I think August 9th or 10th, within a day or so of the disaster declaration. The Emergency Operations Center had been running now for a little over a month and we continued to use that asset to deploy people to the field. Our biggest presence was in Liberia. I think around that time there were around twelve people or something like that. I think in Sierra Leone, two or three. In Guinea, three to four, something like that. Relatively small numbers. But we were starting to deploy a larger number of people to try and get a sense of things.

Upon my arrival in early August, it was very clear that anxieties were running high, that there were cases being reported not only in remote counties in Liberia, prefectures in Guinea, and districts in Sierra Leone—that we needed to scale up more quickly. At the same time, commercial airlines were getting very nervous about this growing epidemic and not wanting to continue to provide commercial airline flights to these three affected countries. So Kenya [Airways] canceled their flights; Delta Air Lines had planned to stop providing services as a business decision about six months before for their flights into Monrovia, but it coincided very well with the anxiety. So there was certainly no consideration for continuing to provide that kind of support. And there were just a handful of airlines left. [Brussels Airlines] continued to provide support, I think out of a sense of honoring the fact that MSF Belgium was the lead MSF agency providing services through clinical care at these Ebola treatment units I spoke of earlier. And the other airline was the Moroccan [Royal Air Maroc], of all things, but the prices for their commercial flights went up many fold. So you had two commercial airlines continuing to provide support. Meanwhile, around the developing world there was a lot of discussion,

particularly in the United States, of closing off all commercial flights to anyone with a linked itinerary coming from these three affected countries, and we were very concerned about this development because in order to have an amped up response to stop this outbreak becoming an epidemic, we needed to be able to have the first responders, the CDC epidemiologists and laboratorians that provide confirmation testing. Other parts of the US government similarly that would eventually become involved including the Department of Defense, the National Institutes of Health, more support from USAID. And more importantly because the isolation of infected persons with Ebola into Ebola treatment units requires that there have to be the non-government organization partners present to provide those services, we needed to be able to get the NGOs to get their staff to the field to provide those services.

This was actually also very complicated in those early days of August because one of the medical NGOs was a faith-based organization called Samaritan's Purse and they had had several of their staff become infected, including an American expatriate. They—after this growing number of cases in Monrovia at Samaritan's Purse—decided to withdraw their involvement of provision of clinical care for Ebola, and that left pretty much Médecins Sans Frontières as the last standing NGO. They were heroic in trying to expand their presence, particularly in Monrovia where they went from forty beds to eighty beds to 160 beds and trying to get ahead, with plans for something even as large as an Ebola treatment unit with more than three hundred beds. But the scale and speed with which the exponential growth of cases was growing was clearly outpacing whatever heroic efforts that MSF could make. Meanwhile, working with WHO and the ministries of health, we

reached out to WHO's rostered foreign medical teams from around the world that normally respond to earthquakes, floods, cholera outbreaks, and other kinds of disasters where medical NGOs typically come in in greater support than there is need. In this case no one was willing to step forward and I think it was because those NGO workers were, one, afraid that if they came, there would not be the training that they needed for this personal protective equipment which is beyond what is usually needed for infection control; two, that the personal protective equipment would run out even if they were trained in using it; three, that if they did get infected, they would not be able to get a humanitarian waiver for their own country or the medevac to get them home to provide a higher level of care; four, even if they did get through their deployment successfully without becoming infected, that their country wouldn't let them return until they had found some place to go after leaving Liberia, Guinea or Sierra Leone for a twenty-one-day incubation period, and there was no one willing to take on citizens that responded to this medical response around the world and provide them a twenty-one-day haven before they could return home; and lastly, if they did get sick and needed to be stabilized for a medevac to their home country, there was no place where they could get a higher level of care than the place where they were working where they were being overrun and not have enough beds or healthcare workers trained to provide care for the locals let alone for themselves.

So you had a complete lack of response from the medical NGO community. You had concerns that all commercial airlines were going to be shut off and a lot of discussion even among state governors here in the US that no more flights should be allowed into

the United States. You also had on the ground in the three countries another crisis or chaos happening and that was that in closing down the airlines it became very difficult for me, as the team lead for three countries, to even travel across the three countries. We tried as best we could to communicate through cell phones, but the cell phone communication was also rather spotty at best and the size of our teams in Guinea and Sierra Leone weren't nearly as big as Liberia. Also in Liberia it was clear that by the middle of August this was the first urban epidemic of Ebola that had been seen anywhere in the world, and we'd been doing Ebola outbreaks for the last four decades, since 1976, and had never seen truly an urban outbreak become an urban epidemic. It was truly tragic. You would see taxi drivers bring Ebola suspect cases to the Ebola treatment units, but there would be no beds available and people were literally laying out in the sun in front of Ebola treatment units having no access to the Ebola treatment units. We also didn't have enough laboratory capacity to do all the testing for all of those with suspect Ebola who would be put into an Ebola treatment unit, and if they tested negative, be taken out where they could be followed by contact tracing teams until it was clear that they didn't develop signs or symptoms of Ebola or febrile illness which would require them to go back in. So you had a complete lapse of infrastructure to support the need and you had the people that were transporting ill people to the Ebola treatment units transporting them in taxis and having vomiting and diarrhea, body fluids in the back seat of the taxi. The taxi driver would clean up the mess without any protective equipment and clearly be exposed and become the next victim.

In the three countries there were these ministry or government-led teams working with international responders to try and coordinate the response, but there was not a clear delineation of authority for the person in charge of the response for each of the respective governments. Here in the US, here at CDC, the reason we have an Emergency Operations Center is because we have an incident management system that provides a clear line of authority for the incident manager. And the incident manager, regardless of what division and center they sit in at CDC—this is the Director's Emergency Operations Center, so the incident manager reports directly in this case to Dr. Frieden on a daily basis, if not more so, and also provides briefings throughout the day for Dr. Frieden or other team leads to coordinate a response and provide structure and support to our teams in the field. That was not happening when I arrived in Guinea, Liberia and Sierra Leone. The World Health Organization has a WHO country office lead and that country office lead in each of the three countries was very weak. They were part of the resistance to call upon for assistance from headquarters, and in addition they had never seen Ebola or anything on this scale before and they didn't have the skills, expertise or the savvy to really provide the support to the ministries of health or the Ministry of Defense or the government in general to advise them on how to respond to this. So they were completely inadequate and unequipped for something of this scale.

Q: Can you talk a little more about how they resisted attempts by the international community to come and help?

Tappero: I think it was just more that Ebola had been seen in other parts of Africa and there was just—because they didn't have the surveillance system in place to see in these respective countries how quickly hot spots were happening in June and July, that they really felt that they could handle that without headquarters assistance. In the United States we have relationships where the federal authorities, the Centers for Disease Control employees, don't have the authority to go into a state to respond to an outbreak. They need to be invited by the states. So in this sense you could look at the relationships between the member states of WHO, the headquarters office and the regional offices as needing that invitation. I think in the United States we have a much lower bar for asking for federal assistance: one, the technical expertise and two, the resources that come with it. In this situation I don't think that the regional offices saw that by inviting headquarters staff that they realized the magnitude of the problem or that there would be additional resources or expertise coming with it. So it's hard to really know what was said behind the scenes but clearly there were many political reasons, there was concern that declaring a public health emergency might affect commerce, might affect a number of things. The International Health Regulations that were revised in 2005 were put in place to ensure that there is an adequate international response for something like an infectious disease threat crossing borders but also to ensure that in the response it doesn't completely destroy an economy or shut down movement of people safely across borders, etcetera. But in this case things were just so far out of hand by the time that the reality set in and I think that happens for a number of reasons.

One, all three countries have been through major civil war and unrest through the eighties and nineties. Liberia, for example, Charles [M. G.] Taylor who ended up being charged in international criminal courts for the heinous acts under his leadership of Liberia, eventually found guilty, etcetera. A lot of child soldiers, a lot of chopping off of hands and things of this nature, diabolical acts. And these things happened over a twenty-year period in all three countries and when that happens, there's a complete shutdown of education and schooling and infrastructure, and these three countries had finally come out of that in the 2000s and were starting to get back on their feet or starting to be able to export products and get children back in school, etcetera. But was a whole generation there of what would be your principle workforce and responders that would be addressing this and there were just clearly not enough people in the public and private sector to respond to something of this nature, and that was because of the civil unrest and wars that they had gone through for a generation of people.

In addition to that history, which put all three countries at a great disadvantage for an effective early response, and the weak WHO country office directors in the three countries, there was also the problem that Ebola had never been seen in West Africa. It had been described in Central Africa and in East Africa but it wasn't on anyone's radar. In Uganda, with multiple outbreaks of Ebola and Marburg, you see a very efficient response by the Ministry of Health, some support from CDC which has a country office there providing laboratory support, technical support, but they know how to manage an Ebola outbreak and they've gotten so much better at it that when it happens now, there's usually one to three cases and the outbreak is stopped rather than something on the

magnitude like Bundibugyo in 2007 or '08 where there were hundreds of cases. So they've clearly gotten better, and in the Democratic Republic of Congo or formerly known as Zaire, where the first outbreak was described, similarly you see a very effective response with a large number of CDC-trained epidemiologists through the Field Epidemiology Training Program being deployed to clusters of illness among healthcare workers resulting in death, a harbinger for Ebola or Marburg, and an effective response. But you had never seen Ebola or Marburg laboratory-confirmed in humans in the three affected countries. So the ministries were not trained, didn't have their radar up for the possibility that it would occur in their region. And so between civil unrest, nascent public health systems, governments coming out of civil war and chaos into some semblance of responsibility and democratic leaders, you had sort of the perfect storm for inadequate early response.

Q: Did you ever encounter personally resistance specific to CDC coming in and doing anything?

Tappero: I never personally experienced, at the national government level, resistance from the Ministry of Health or in Liberia, for example, President [Ellen Johnson] Sirleaf who I met with many times and had a great deal of support. When you were clearly out in rural areas, there was a lot of suspicion within communities. For example, for most citizens of these three countries febrile illness is not uncommon. There are an estimated million infections across the three countries every month and the number one cause of febrile illness is malaria. So people coming to a health center with a febrile illness is not

an uncommon thing, and people leaving a health center with medication and surviving their illness is more the norm than death. Seeing healthcare workers die after contact with someone with a febrile illness is also not the norm. So here you have the recommendation from healthcare workers that you're ill and you need to be isolated, and when we can provide supportive care, oral rehydration for example, to people with Ebola infection, we increase their chances of survival about twofold. But in the absence of any care, mortality is 80-90%. With supportive care mortality is 40-50%. And the communities don't understand that when they're normally going to a health center and they get well with a febrile illness, here it is good news that only one out of every two infections would lead to death, where in fact nine out of ten would lead to death without any care provided at all. And healthcare workers with inadequate personal protective equipment and with inadequate training in how to use that equipment and with isolation facilities that allow them to separate these individuals with Ebola from the other clinical services that are needed to be provided at health centers because of malaria or diarrheal disease is common, respiratory infections are common, complicated pregnancies for women, etcetera. It creates a real challenging environment and lack of trust because the communities don't understand. Before when we used to get sick we used to get better. Now we're getting sick and we're dying.

In addition, the management of Ebola requires that all persons who die of Ebola have a safe burial. Now, traditionally in these three countries, burials are an important part—as they are in all cultures—of the caring for your loved ones. And in these three countries there is largely the belief that people, when they die, will go on to be with their ancestors,

and they need to be appropriately washed by the close family members or the village community. Often after being washed and put into the clothing that they will be buried in, they are often carried throughout the village in ceremonial events to commemorate their lives and to have a family send-off for their wellbeing and greeting their ancestors. And here, the international community is saying, hey, need safe burials, we need to take your deceased. And people are dressed in personal protective equipment that looks frightening and unfamiliar, and they are taken away in a plastic bag and they will never be seen again. They don't get to have that family embraced opportunity, and because there was so much death occurring, the concept of providing a safe distance for family members to see that their loved ones are being buried even if they can't touch them also wasn't possible. And in some cases in Monrovia the early response to the increasing number of bodies dying in the communities was to have the crematorium be a place where bodies would be delivered by truck in large numbers for cremation en masse rather than individually, and clearly that is something that was not in a part of town where family members could come and see their loved ones being cremated in large numbers together. So very disturbing stories, rumors, and often the communities would feel that, hey, if I get sick, I don't want to stay here, I will get picked up by individuals wearing crazy clothing and I will be cremated or put in a plastic bag and not be buried by my family. So the knee-jerk response in many cases was for people that knew they had been exposed to someone with Ebola, could see they were getting signs and symptoms of illness, was to return to their home village for support and traditional burial that they were familiar with and where these authority figures wouldn't prevent that from happening. Unfortunately, that leads to more hot spots and further spread of potential new Ebola outbreaks in rural communities.

The other kinds of resistance that we could see was in the call centers that were established early on, so that if there was an unexplained death in the community, there was encouragement to call the call centers and the call centers would then provide the safe burial teams that would go out, and usually it requires a truck or ambulance that can be sprayed down with chlorine after pickup of a deceased so that it could be safely used and reused. And the teams were largely made up of six to eight members, four people to carry the body, another person with a chlorine sprayer behind to make sure that any body fluids that leaked were decontaminated and also to wash the individuals carrying the deceased, making sure they didn't have a breach in their PPE [personal protective equipment]. And then a driver and someone as a lookout for the driver to make sure that they also, not wearing personal protective equipment, don't have exposure. So you have five to eight members on a team and in the tropical heat and sun wearing this personal protective equipment, and the number of calls clearly outstripped the number of burial teams available. It became a very challenging environment. It's probably safe to say that a burial team can pick up in an urban environment six, maybe eight, at max ten bodies per day, doing it safely, and then being exhausted at the end of the day. But at the time there were only four burial teams in early August in Monrovia and our back-of-the-envelope figure suggested that we needed about thirty-two burial teams, and so clearly the bodies dying in front of the ETUs or in communities or homes were not being picked up. Communities were given instructions to call the call centers for burial teams, but the number of burial teams available to pick up the deceased were inadequate. A decaying body in a tropical environment at home begins to smell, it begins to leak fluids. Families

would choose to move the body on their own when there wasn't a safe burial team arriving within a reasonable period of time to take the body away. You would see in many cases adults and children rolling the deceased down the street to get away from their home, clearly with exposure. And often, because these are such poor countries, the materials left behind in the home would be looted and they were contaminated and could also result in transmitting Ebola infection.

Another failure, if you will, was that the emergency response stood up by governments in each of the three countries—because they didn't have experience with an emergency operations center or an incident management structure, the typical response is that the person put in charge would go through the layers of government that would provide advice to the more junior leader. In Liberia I witnessed first-hand, and it was happening in all three countries, that the person in charge of the response would have to go through many of the minister-level leaders of government with what the plan was for the day to address several different aspects of the response and you would get conflicting advice from different ministers. What we really needed to have was like in our own incident management system, that the incident manager could report directly to the President given that this was a disaster declaration and that the individual could make decisions quickly. If the response decisions that were being made were not effective, then they could adjust and try something different without feeling retribution or punishment for not being effective. And I think Dr. Frieden's visit at the end of August to all three countries, meeting with the presidents of all three countries, hearing from the international response members about who was the most effective person with government that could lead the

response—and in most cases it was the individual that the government had already identified—but to remove the layers between that leader and the president of the three countries was critical and also unprecedented. That hadn't been seen before, that an incident manager would—for example, in Liberia an incident manager was a member of the Ministry of Health that would report to the President, not the Minister of Health. Unprecedented. But once that happened, then the international community could start having a good response and so CDC, our team started to grow in number. WHO, because of the declaration of Public Health Emergency of International Concern, allowed senior leaders from WHO to come in and provide technical support, speaking a common language with CDC, working together to provide that kind of support, having the Ministry give direct access to the President, President Sirleaf, and to also have a daily two-hour meeting with the incident manager from the international community to agree together on how to strategize and prioritize limited resources and set priorities for the response. And lastly, WHO, once they had their headquarters people brought in, they replaced their weak country office leaders with stronger, more experienced disaster emergency response leaders, and so it became a much more effective response.

Q: I have a couple of follow-up questions on all of this. Regarding the community resistances to help, and this is again, I want to get us to personal experiences pretty quickly here. So there's community burial traditions and behaviors that would potentially spread Ebola, but is there a way to weigh that against the lack of ability for burial teams to come in, the lack of structural support?

Tappero: Yeah, I think behavioral change and social mobilization is clearly an important part of all of this and every small rural community was a little bit different. In some of these communities they didn't have personal protective equipment or trained burial teams to even provide the service. And I think also you have to understand that most of the international response that was provided by experienced public health epidemiologists and laboratorians, these were people that were not West Africans. There's a lot of lack of trust of outsiders when you consider the history of the recent civil war, when you consider the history of slavery in West Africa, when you consider the postcolonial era relationships between governments that were the colonial occupying powers in the postcolonial era was not always good, particularly between the government of France and Guinea. The relationship between the UK [United Kingdom] and Sierra Leone was better and the relationship between the US and Liberia was probably the best of the three, but nevertheless there was still, in the rural communities, lack of trust and understanding. So we learned a lot about social mobilization and behavioral change in communities, but even in the last six months as we've gotten to zero in the three countries, we still saw that communities that were seeing Ebola for the first time or communities that had seen Ebola and seen their loved ones taken away without the opportunity to participate in a traditional burial, that they would continue to hide illness resulting in new chains of transmission. So there is a lot of history there that anthropologists and others tried to assist in bringing awareness in communities.

There was increasing, over the eighteen months, effort to bring in religious leaders, community elders and educate, educate, educate about what is this infectious disease,

how it is transmitted, why it is so important to isolate quickly, why it is in no one's best interest to go underground, hide or move away, and that your best chance for survival was to be isolated and protect your family members and your community from further transmission and increase your chance of survival twofold. So that work—even though it sounds so logical to us who are very familiar with, through our education, the infectious disease model of another organism causing an infection in humans, it is not always so easy to convey that message in rural West Africa where there had been little in the way of formal education for a couple of decades until maybe the last ten years. So I think there was a lot there.

I think there were other challenges in this response early on as well. First, schools were closed across all three countries for almost eight months minimum and up to a year in one, and that made it hard to continue to provide education to youth and also made it hard for children to have something to do. So that was a challenge and it also made it hard for educators in these countries to contribute by sending education messages to their communities. Another challenge was that once a health center experienced Ebola and death among one or more of its healthcare workers—and I think something around five hundred healthcare workers died across the three countries—it literally led to a shutdown of the health center, and the health center provides critical services. There is effective treatment for malaria, but when the health centers shut down, it doesn't happen. There are routine childhood immunization services even in these poorest of poor West African countries that ceased and stopped providing immunization services to the newborn and children under five that are to receive at least six recommended immunizations under

World Health Organization guidelines, and even more with today's expansion of immunization services and different vaccines that have been proven to be effective. So cessation of treatment of malaria, cessation of addressing common colds, diarrheal disease, childhood vaccine preventable disease. And importantly also maternal mortality in these three countries is about as high—maternal mortality and under-five mortality—is about as high as anywhere in the world, and so complicated deliveries, there was no place for a woman with challenging obstetrical history or a known complicated pregnancy that needed assistance, perhaps C-section [Caesarian section] or assistance with vaginal delivery, there was no place to receive those services.

I have one particularly telling example of the impact of the Ebola epidemic on healthcare infrastructure. This is the story of Dr. Melvin Korkor from Bong [County, Liberia], and he is someone that we actually brought to the September 26th ministerial event at the White House for the Global Health Security Agenda and Ebola response in September of 2014. Melvin Korkor was the number-two physician at the Bong regional hospital, and this hospital was known for its ability to provide services for complicated pregnancies, and they had a surgical ward for complicated pregnancies requiring C-section, etcetera. Dr. Korkor had a number of nurses that provided care services on the ward but only a couple of doctors that actually provided oversight for the clinical care given. So in Bong there was a woman who was in her fifties who had come to the hospital and Dr. Korkor, upon her arrival, was in the operating theater for a number of cases that day, and the woman was thought to have typhoid fever and she received IV [intravenous] fluids and was moved on to the medical ward for provision of care. As she got sicker and had

profuse vomiting and diarrhea, many of the nurses had been exposed, and by the next morning when Dr. Korkor saw the woman and spoke with her and saw the signs and symptoms of illness with severe vomiting and diarrhea and also heard her accent that she was clearly from Lofa County where he was from, it all clicked in his mind that this could be an Ebola case. So he immediately instructed his staff to move her to a section of the surgical ward that would isolate her from other patients and instructed them to maximize their personal protective equipment although they did not have at this facility the kind of PPE that we would normally have expatriate and locally-trained workers—by people experienced in providing care for Ebola with the full PPE outfit. Anyway, he was able to isolate her. She eventually expired and then he was clearly feeling the responsibility to do his own contact tracing, if you will, by having all of the healthcare providers in his hospital monitored for signs and symptoms of illness. And one by one his nurses started to become ill and he sent them to the MSF facility in Monrovia for care by ambulance, and sadly learned that they had laboratory-confirmed Ebola one after the other. His favorite nurse was a nurse who was very much respected by the community and who had great bedside manner, and as she became ill, she approached Dr. Korkor and said, “I’ve got a febrile illness, I’m very concerned, I’ve already taken antibiotics for diarrhea.” He suggested that she take treatment for malaria, and in a moment of human weakness he gave her a soft hug or a pat on the back and told her that he would be there for her. She eventually was laboratory confirmed and also transferred down to ELWA 2 [Eternal Love Winning Africa Hospital] in Monrovia.

Then he himself decided, I'm potentially exposed, I need to stop providing clinical care services, and he self-isolated at home, told his wife and children to stay on the other side of the house, told his wife to bring food to his door and leave, etcetera. As he became febrile himself, he demanded that his blood be tested. The laboratory staff looked to this physician with such reverence that they tried to hide his sample from being sent to Monrovia for confirmation. But he suspected that would happen and when he looked at the carrier for specimens to be sent for suspected Ebola patients, he saw that his blood tube was not there. He insisted that it be put in the carrier. Later received the next day that he had laboratory confirmation of Ebola, and he insisted that he himself be transported and that he would be transported like any other patient, in the back of the ambulance, not in the front with the driver. He arrived at ELWA and saw that a couple of his nurses had already expired, but there were still two alive but he could tell that they were going to expire, including the woman that he had embraced and was so close to, and she expressed to him, "Please take care of my children, Dr. Korkor, I know I'm not going to survive." And the other thing that happened was that he had a cell phone and was able to call a sister who lived in Monrovia and explained to her that he needed to have food brought twice daily and clean water. Clearly the facility was being overrun. There was not enough clinical care services to even provide clean water and hydration. So he insisted that his sister bring that and he would provide his own nursing care. He knew enough as a doctor to pinch his nose, force feed himself for nutrition, get through his vomiting and diarrhea, continue to take nutrition and make himself hydrate with oral rehydration solution prepared from clean water. And he survived. He was only one of ten healthcare workers at that facility who survived and he did so because of his own

knowledge and ability to provide his own care in a dire situation. And when he returned to Bong, he was somewhat ostracized from the rest of the remaining healthcare staff and community who knew that he was an Ebola survivor. Even though he was afebrile and well and could provide support, he was no longer welcome, and his children experienced the stigma, as did his wife even though none of them got ill. He actually, through his knowledge as well as his response, was able to spare them from Ebola infection at home. So it's just one of those classic stories of a tale.

Myself, in the early days of August, we went out to many healthcare facilities in Monrovia that were either shut down or had seen cases or were at risk of seeing cases in having transmission in healthcare facilities. We did our best to provide infection control training and practices and advice, to talk about the importance of isolating healthcare workers who had taken care of Ebola patients, make sure that they were monitored twice daily for febrile illness and if they were, to separate them. Tried to work early on knowing that there just weren't enough Ebola treatment units, no foreign medical teams coming, potential threat of closure of airport commercial services, that we had to make sure that these healthcare facilities that we knew would be overrun with potential Ebola patients—to maximize their efficiency. And in many cases our first arrival we were already too late by the scourge that was affecting their healthcare facility. I remember on several occasions seeing things that were so draconian in nature, like Dante's *Inferno*. A woman on her gurney who clearly had died of Ebola and yet was still having a child nursing at her breast. I remember visiting the Ebola treatment care unit at JFK Hospital [John F. Kennedy Medical Center] in an annexed facility that had once been used for

treatment of cholera patients where they tried to set up a standalone isolation unit and seeing adults on gurneys dying of Ebola and their children underneath their gurneys because there was no place for them, knowing they were going to get exposed and that these children would die. Kind of heart wrenching experiences, and knowing that unless there was an international response, unless there was the building of Ebola treatment units or at least the effort in communities to take an existing facility, identify and set up structures to isolate people with Ebola and separate them from their communities, that this was going to go on and on.

Meanwhile, there were modeling efforts about epidemics being conducted here back in Atlanta by Martin [I.] Meltzer and their team. Their estimation, based on the number of reported cases—clearly there was underreporting of disease, but even with what data we had coming through these early surveillance systems the prediction was that in the absence of isolating 70% of all new infections, we would see up to a million and four [1.4 million] Ebola cases and up to a million two [1.2 million] deaths within the next four to six months, and that I think caught the attention of the international leaders including President [Barack H.] Obama. MSF and many across the USG [United States government], particularly CDC, were also calling for the Department of Defense to become engaged. We really needed their logistical support and their infrastructure, their BSAP, their ability to help us communicate and transport personal protective equipment, if there was a need for large-scale mass evacuation through medevac, etcetera. We needed to have that larger capacity than what was available through the commercial airlines or a handful of medevac planes. In the middle of September, President Obama

came to CDC to be briefed and I happened to be one of the handful of briefers and I had just returned from Liberia. I remember fondly President Obama going around the room and shaking hands his first visit to CDC. He came around to me and I said, “Sir, I’d love to shake your hand but I just returned from Liberia, I think I best not.” He said, “Good on you,” and we had an elbow bump. It was a very touching moment for me. Because I was the only one in the room who had just returned from theater as well, he was very much focused on my briefing. In as straightforward and brief presentation as possible, I explained the problem with not enough beds for the absolute number of patients and that we needed a systematic global response to turn the mathematics around on that relationship. And that afternoon, I’m sure with a lot of input from Dr. Frieden privately, etcetera, he announced that four thousand members of the Department of Defense would provide care. That was critical. I think it was critical just because it built so much confidence.

Now, the Department of Defense—sadly, in my opinion—never took the opportunity to also have its medical personnel, who were more than willing, provide clinical care in this response. It would have helped them have a real life rather than a tabletop exercise of managing a large infectious disease epidemic, pandemic; one that they need expertise with in case something like a 1917-18 pandemic influenza strain were to reemerge, or if there was sadly a nefarious individual or group that would create through molecular manipulation a serious strain through terrorism of a lethal agent that could be used, and the Department of Defense would clearly need to respond to something like that. But they didn’t see it as their mission. They were worried about their staff personnel and how their

family members were [unclear] at home, and so the Department of Defense limited its mission to providing the logistical support and equipment and assisting with building Ebola treatment units. We also suggested to them that their Seabees and their Army Corps of Engineers use local materials and work with Liberian military to build things that are very simple and quickly, but their standard operating procedure is to use their prepackaged materials. I remember very clearly having multiple discussions in July and in August with Department of Defense leadership and suggesting to them, and with the support of Dr. Frieden, that they provide these Ebola treatment units and not even be involved in the clinical care but provide the physical infrastructure. Because they used their prepackaged mass units, if you will, they were way beyond anything that we needed, and in addition, the cost was out of any of our capacity to pay for them because if they were going to provide them, they weren't going to take them back and decontaminate them, they were going to leave them.

I remember in mid-August there was one offer for a twenty-five-bed medical unit that they could provide for X number of millions of dollars and I said, yes, we would accept that unit. The DART for OFDA was very upset and the person on the other end of the phone from the Department of Defense was also extremely upset. But I had spoken with Dr. Frieden and we had assurance that if we said yes, we knew what we would do with this unit and it would be to provide a higher end of care for healthcare workers, whether they're Liberian or expatriate, where they could receive a higher end of care to stabilize them. In Liberia, giving Liberians the best chance for survival and for expatriates to get the best chance for stabilization for medevac to their home if they could receive care

through humanitarian waiver in their own country. In the United States, of course, we were able to ensure that with care given at University of Nebraska Medical Center, Emory University and the National Institutes of Health. We also needed the Department of Defense to man and provide the clinical care services at this unit. As you know, as I've said already, they declined to provide that kind of support. I was very proud, as a rear admiral in the Public Health Service now and at the time a captain in the Public Health Service, that our leadership at PHS not only accepted the challenge of being trained and providing clinical care in this Monrovia Medical Unit as it later became called, but that they had on first call over 1,700 volunteers to the mission when they asked for volunteers to provide either the direct clinical care or the logistical and administrative support to run the Monrovia Medical Unit for expatriates. A similar strategy for provision of care to expatriates and locals who were direct front responders to the response was adopted later in Sierra Leone and Guinea. I think that combination of the Department of Defense coming, that there would be one clinical care unit providing a higher end of medical care for locals as well as for stabilization for return home, brought an enormous amount of confidence to the medical NGO community and to the foreign medical teams that were rostered to start receiving the training like we provided in Anniston, Alabama, or that other NGOs knew or went to MSF or others with that expertise to attain, and provided the pre-deployment training for PPE and management as well as ongoing training upon arrival for this response. And I think that that's why you saw finally the response peak in Liberia and a decline by March of 2015. It was a little bit later in Sierra Leone and even later in Guinea but it appears now that we're almost at forty-two days or more across all

three countries and I think the countries might now be through the worst of it. I would say that one of the biggest—

Q: I'm sorry, can we take a quick break? Thanks.

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