CDC Ebola Response Oral History Project

The Reminiscences of

Lisa Delaney

David J. Sencer CDC Museum

Centers for Disease Control and Prevention

2016

Lisa Delaney

Interviewed by Sam Robson
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Interview 1 of 1

CDC Ebola Response Oral History Project

Q: This is Sam Robson, here with Lisa Delaney. Today's date is March 9th, 2016 and we are in the audio recording studio at CDC's [Centers for Disease Control and Prevention] Roybal Campus in Atlanta, Georgia. I'm interviewing Lisa today as part of the Ebola Responders Oral History Project. We'll be discussing her life and career and especially focusing in on her response to the 2014 Ebola epidemic. So Lisa, thanks for being here.

Delaney: Thank you for having me.

Q: Of course. For the record, could you state your full name and current position with CDC?

Delaney: I'm Commander Lisa Delaney and I'm the Associate Director for Emergency Preparedness and Response for NIOSH, which is the National Institute for Occupational Safety and Health, which is part of the CDC.

Q: Thank you. Can you tell me where and when you were born?

Delaney: I was born in Ashland, Kentucky, on January 21st, 1975.

Q: And you grew up in Kentucky, right?

Delaney: I did, yes.

Q: Can you talk to me a little bit about that?

Delaney: I grew up in a fairly small town in northeast Kentucky and my mom and my dad raised me. I had a really nice—I'm an only child, but I had living grandparents, which was really great because I know a lot of people don't have grandparents and so they were really a big influence on my life. That sort of extended family with my grandparents and my aunt, my two aunts. I think it was probably a pretty ordinary childhood. I liked to dance. I didn't really do sports, but I loved to dance so I took ballet all through high school.

[interruption]

Q: So you get to high school and you're interested in science and you had some family influences that were really important to you, right?

Delaney: Yeah. My grandmother Evelyn Delaney was a nurse at our local steel mill in my small town and she would tell stories of how she had to treat men who had injuries or had chemical exposures or burns in the work place. Steel making is a very dangerous

profession. So now with what I know about occupational safety and health I can only really imagine what she saw. She would tell these stories and they were really compelling of how they would help and the men would be so upset with her when they were first coming in to be treated and she'd prep them and get them sent off to the emergency room. She told a story of a man who came back and—he was cursing her all the way through when she was cleaning him up and trying to get him to the hospital and he came back with flowers because he was just so grateful and he really appreciated what she had done for him. So that really resonated with me. My grandfather worked at a dairy, so I always got wonderful ice cream and that was really fun, but I got to see the work and the hard labor and the toll it took on his body, he had exposures to asbestos. And so all of that really influenced ultimately my decision to go into industrial hygiene, the practice of occupational safety and health in the workplace because I know every worker deserves to go home safe at the end of their work day and not be negatively impacted because of what they're doing to make a living for their family.

Q: Sometimes this issue gets politicized a little bit. Were there political issues in your family that kind of predisposed you to wanting to make sure that workers are healthy and safe?

Delaney: I would say that my family were proud Democrats and union members, so I saw that you really did have to advocate for the worker and you needed people to advocate for the health and safety of workers because that's not always what some industries make as a priority. I think there are some really great companies out there that want to do the right

thing, but there's others that either they don't understand, they're too small, that they don't have their adequate resources to protect their workers because it does impact their bottom line. So, it's important that you have places like NIOSH and OSHA [Occupational Safety and Health Administration] and labor unions that can provide training and education and awareness and resources to help improve the health and safety in workplaces.

Q: Can you tell me a little about—so we're in high school, were there teachers who especially influenced you?

Delaney: Well one of my fondest memories was in seventh grade, and I think this was really what sparked my interest in the sciences. I had a teacher, Mrs. Henry, who taught us biology, and she drew on this chalkboard in all these different colored chalk the cells; the plant cell and the human cell and all the different [structures] in the cells. It just really sparked a love for me. I just remember thinking this was the greatest thing and being able to look at different organisms under the microscope and for me that really began my love affair with especially biology. I think growing up you don't realize much about opportunities other than going into say the medical field, nursing or becoming a physician. I didn't know much about public health before I looked and found some brochures in college. I went to Centre College, which is a small, liberal arts college south of Lexington, Kentucky, and it was a wonderful place to go to school. It was just a very special place, very strong connections with teachers and professors and they knew you by name and very small classrooms. I was able to pursue my love of science, but I also

actually have a double major in Spanish, so that kind of balanced me out of taking science classes and then going and reading an eighteenth-century Spanish literature book.

I decided that I didn't want to go into the medical field. It was just a lot of work and all the struggles and the effort to get into medical school was just too much for me, I didn't want to do it. I had to decide what I wanted to do and I really didn't know. So I spent some time—back then we had brochures of different programs, different graduate programs. I stumbled across a couple that really caught my attention. One was in microbiology and the other was a program in toxicology. Once I drilled down into the tox program, I found that there was another program in that department that was something I was more interested in and that's where I realized, learned about the profession of industrial hygiene. I decided—and drawing from my experiences and what I saw with my family—that I really wanted to pursue that. I thought it was something I could really have, something tangible—a degree that I can do something with. I could go into a workplace and I could identify hazards and then I could make recommendations to mitigate those hazards. I packed up, went to the University of Cincinnati in 1997 and got my master's there.

A very vivid memory that I have is the first week of school we were touring a wastewater facility. They really believed that we should, as a program, we should get out, we should be in the field. We should go through walkthroughs, is what we call them, and we look for health hazards and apply what we were learning in the classroom. So the first week of school we were in a very smelly wastewater treatment facility looking for hazards. I had

no idea what even to look for except oh, there's a hose on the floor, you've tripped, that's a trip hazard. But I was still determined. I wasn't dissuaded by the smelly wastewater treatment facility. I stuck it out and I spent two years at University of Cincinnati getting my master's degree. I spent some time in the private sector as a co-op at General Electric and I really thought that I was going to pursue a career in the private sector and a job opportunity came up about halfway through my second year in the master's program. I applied sort of on a whim. I still had some time to go to finish my degree, so there really wasn't an urgency there, but I got the position at NIOSH and I decided to accept it. I thought it would be a great opportunity to learn from professionals and this position was in the health hazard evaluation program. In that program we get requests from either workers or employers who have a concern about a health hazard in the workplace. That could be driven by a concern about a product that's being used or generated or it could be because of a cluster of health symptoms or health effects that are being observed in the workplace. They want to bring in groups to assess the hazard and make recommendations.

For a number of years, I think I was in that program about six or seven years, and it was great. I got to see really neat things being made that you never get to see, like tires and mattresses and construction projects and aquaculture facilities and casinos and all the different workplaces across the US. It was really interesting and I learned a lot doing all of those field studies.

Q: So what was it you think that caused you not to go back to the private sector after two years or so?

Delaney: My fellowship was a two-year fellowship and it ended on September 7th, 2001. I was at that point applying for a permanent position, but that hadn't gone through, so I was doing this sort of strange bridge until that paperwork got through and September 11th happened and I spent a lot of time in what was the emergency operations center that CDC had at the time, which was a conference room, which is much different than what we have now where we have whole floors and buildings dedicated to emergency operations. At that time it was a conference room. It was an ad hoc conference room. We rolled in some televisions and worked out of that area. I think I really appreciated what we were able to do and accomplish and support in the response and to help the workers. If you remember, 9/11 fed right into the anthrax letter mailings that occurred just a month later and so basically, that entire fall [was] spent dealing with the aftermath of both of those events. That really inspired me to really dedicate myself to public health and CDC. I joined the [Commissioned] Corps. I started the paperwork for the United States Public Health Service just shortly after that and was commissioned about a year later.

Q: So throughout these years, is there anyone you would say who was especially influential for you?

Delaney: Well I would think all of my coworkers in the Health Hazard Evaluation Program, which was the Hazard Evaluations [and] Technical Assistance Branch, we were

really a family and I felt that on every level. When you travel so much with people, you really can kind of break down those walls and barriers that maybe you have when you're just punching in an eight-hour day, but when you're getting up at 3:00 in the morning and hanging sampling pumps [on workers to assess their occupational exposures] or stuck in an airport on a snowy night and can't get home, you really get to know those folks. Everyone in that branch was so supportive, especially being such a junior officer. At the time, when I started at NIOSH, I was the youngest person in the branch. I can't say that now unfortunately, but at the time I was, but everyone was really—I was just impressed with just how technically smart and on point people were and how supportive and willing they were to help and mentor me. I would say one of the most influential persons in my life, my career, and I consider a mentor is Max Kiefer. Max was my boss here in Atlanta when I transferred. I started out in our Cincinnati offices and then shortly after I moved to Atlanta. So I've spent most of my career at NIOSH here in Atlanta, which is unusual because most of NIOSH is spread out all over the US. We have a large presence in Cincinnati, Ohio; Morgantown, West Virginia; and Pittsburgh, Pennsylvania. Max was a mentor to me here in Atlanta as an industrial hygienist both in my personal life as well as my professional life.

Q: Can you tell me what year you moved down to Atlanta?

Delaney: I moved to Atlanta in 1998. Is that even possible? Yeah. No, no, no, no. 2000. I moved to Atlanta in 2000, and this is a funny story. I had a two-year fellowship. It was a one-year fellowship in Cincinnati and with the option of extending for another year. So

about halfway into my one-year fellowship, my branch chief who's a really formidable woman, very wonderful but formidable, came into my office and said "Lisa, we're budgeting for next year. Are you planning on coming back?" I had to look at her and say "No, because my boyfriend lives in Atlanta and I have to be with him." So, I thought this is career suicide. I've just said I'm not coming back, even though I love it here and I want to stay, but I had decided I really needed to—my boyfriend and I at the time had decided we were going to spend a year apart and then we're going to come together wherever that may be. A couple days later, she came into my office and said, how would you like to transfer to Atlanta? We have a field office there and you can work your second year of the fellowship in Atlanta. So, that's how I came to Atlanta and I'm happy to say that I will be celebrating my fifteenth wedding anniversary this summer with my then-boyfriend, now husband. So it was the right move to make.

Q; Sorry, I cut you off when you were talking about Max Kiefer.

Delaney: Oh no, just Max is a wonderful person. He actually held the position that I hold now. He left the Health Hazard Evaluation Program and was one of the first associate directors of emergency preparedness for NIOSH after 9/11 and he led the response during Hurricane Katrina for NIOSH and now he's in our Western states office, so we still talk.

Q: So what are some of the projects that you were involved in throughout the 2000s that really stick out?

Delaney: Well while I was pregnant, I did a big TSA [Transportation Security Administration] study. After 9/11, when they stood up more aggressive screening of baggage for passengers at the airports, there really weren't spaces at the airports for this activity. So when they were really under the gun to set this screening up—and this is the baggage, not the passenger screening that you see, but this is sort of the back side of the house. They had to put them where there was space and they're not the greatest areas in the airport. So we had TSA employees who were concerned about potential exposures. One of the issues is that the airline tugs that would pick up the luggage after it's been screened by TSA, they would idle while they were loading them and leave them idling. So you've got a lot of exposures to combustion products and the exhaust and those tugs usually aren't really well maintained either, so then that increases the potential for different contaminates. And they're in partially enclosed spaces. Every airport was different, so TSA requested that we go in and look at several different airports and look at exposures. So I did a four-airport study looking at that in West Palm Beach, Miami, Dulles and BWI [Baltimore Washington International Airport] in Baltimore. That was kind of an interesting study because we got to see things that you don't normally get to see in an airport and run around the airport. I was in uniform and our uniform looks very similar to a pilot's uniform. So, I often got asked lots of questions about where to go in the airport, which I couldn't answer because I didn't know. I was just a NIOSH health hazard worker.

Q: Well, not just.

Delaney: [Not] just, that's true, but I certainly wasn't the expert on the airport. What are some other exciting projects that I worked on? I think we spent a lot of time after 9/11 and the anthrax letter mailings trying to sure up our preparedness to better respond, especially to a bioterrorism event. Anthrax, which is the disease caused by the organism *Bacillus anthracis*, probably represents one of the worst-case scenarios because of its environmental persistence. It can sporulate and live in soil, in environments for decades. It's very difficult to inactivate, so it can be persistent for long periods of time. We were criticized and there were a lot of gaps in response that were recognized in 2001 after the letters were mailed and several people died. So we have spent a lot of time and continue to spend time trying to better prepare. One of the things that we did was develop a sampling method because of the importance of assessing and determining contamination in an environment. We developed sampling procedures and we worked closely with laboratorians on how the samples would be processed, and then translated that into a field collection procedure that first responders could use to collect samples. So that's something that I'm really proud of and we've worked really hard and coordinated with our other federal partners who'd be part of that response to make sure that they have those methods and can use them.

We did a big field exercise in Idaho, it actually took place on the anniversary of 9/11 ten years later. We brought together the federal partners who'd be involved in responding to an anthrax event. So we had a scenario, it was a letter that had been sent to a facility, and we used a surrogate, so a very harmless *Bacillus* surrogate, and released it in the building and we played it out as if it were a real event. So we had public health, we had the FBI

working together and then we transitioned to the EPA [Environmental Protection Agency], who's involved with characterization and cleanup and recovery activities. We all worked together. We actually took true samples, and those samples were sent to public health laboratories for analysis, so that gave them experience in processing samples that they wouldn't ordinarily have that experience because we don't have too many anthrax events happen, thankfully. So that was really kind of an exciting—it was a lot of work and planning upfront. I was an exercise planner and evaluator, and then I secured funding and brought in staff at NIOSH so they could get the experience of working in that environment because many of the folks who'd worked previously in the 2001 response were now retired or had moved up the chain and were in leadership positions and wouldn't be the folks going out into the field. So it gave an opportunity for some of our junior staff to get experience that they wouldn't ordinarily have.

Q: During this time, you said you were pregnant doing the TSA thing, and you gave birth to your son Declan? Did I get that right?

Delaney: Jackson, I was pregnant with Jackson during the TSA project and then two and a half years later I had Declan. So I have two children. I'm actually the only person in my office who has kids and I'm the boss, so that's sort of challenging at times, but we make it work. But I have a really supportive family and husband that enables me to do what I do and find that balance.

Q: And what does your husband do?

Delaney: My husband is an industrial hygienist as well, so we met at the University of Cincinnati. He's in the private sector, so at this point in his career he's the director of environmental health and safety for a company.

Q: Okay. So, what were you doing immediately prior to the Ebola epidemic?

Delaney: About a year before, July 23rd, actually a year before, I had taken over as the Associate Director for Emergency Preparedness and Response. I previously had been the deputy and our associate director retired, so I had taken over the position. We had actually been involved in a number of very small responses. Leading up to Ebola we had been involved in a couple of responses. H7N9, [avian influenza], in China was happening. We were dealing with a potential infectious disease issue related to body donation centers and working with the FBI on that project. I was trying to establish myself as the head of the office and put my spin on the office, develop processes and staffing, making sure we had what we needed. Then I got the call July 2014 from colleagues actually in the infection control group at CDC saying, we really need your help. We've got to start pulling together our resources and doing what we usually do during an emergency.

I will say this, that our response and the years that we spent planning for a pandemic influenza response and then actually going through the H1N1 pandemic really trained all of us on how we need to work together and who the people are in the various teams and

task force at CDC because most of us will come together regardless of the event. We'll work in the EOC [Emergency Operations Center] together. Workers are a common denominator in any response. So whether it's a natural disaster, a bioterrorism event, or an emerging infectious disease, we're going to be at the table promoting and advocating for the health and safety of workers. We know who the other folks in the CDC are that we naturally will collaborate with on those activities. Even though at that point it was more of an international response, we recognized that our domestic stakeholders that we typically work with during responses would have questions and concerns and there were activities that we needed to stand up now, at that time, 2014, to be responsive and prepared for potential cases that might arrive in the United States.

Q: Who would some of those partners be who might have questions?

Delaney: I think one of the first groups was the EMS [emergency medical services], so people that would be involved in transporting someone who was sick with Ebola to the hospital. Healthcare workers, PPE [personal protective equipment] manufacturers, because when there are high demands on certain types of products, they need to be aware that there might be higher orders placed and that they may need to be prepared either to triage or ramp up production if that's possible. And our unions, our labor unions. We had a model that we established during H1N1 where we would have calls set up with them to answer questions and concerns that they might have. And then we reach out to OSHA, the Occupational Safety and Health Administration, as well—work closely with them.

Q: And so the previous epidemics that you had been involved in, like H1N1 for instance, it sounds like what normally could be kind of segmented parts of CDC, you had gotten the experience of coming together and seeing what it's like to work across divisions and branches, etcetera. Were there some groups that you worked with especially tightly in those?

Delaney: Yeah. During the Ebola response, we followed a model very similar to the structure, the response structure that we set up for pandemic influenza, and we were part of what was called the Medical Care Task Force. Within that task force we had the clinical groups, the healthcare delivery, the healthcare infection control team, it grew. It grew by leaps and bounds. There were a few of us in the beginning and then by the end it was just this massive group. That included all of the trainings that took place at Anniston for healthcare workers who were going to be going to West Africa to train them on how to properly use the PPE, personal protective equipment that they would be required to wear. So that was one of the largest task forces in the EOC and a lot going on.

Q: Tell me about what happens when you get the call and what your thoughts are.

Delaney: It's always a slow roll at first. It starts out with you starting to participate on the incident manager calls where you really see across the teams what's happening and what the issues are. Then you start getting inquiries that you need to respond to and requests to review guidance documents and I looked at it as almost two responses in one. So you had the international response, which is really where the cases were, and we had to focus on

that in order to stop the spread of Ebola at the source, but you also had to plan domestically for the potential for cases to come into the US and whether that's from medical evacuations or an imported case from someone who has traveled, had recent travel to those areas and then becomes sick once they get back to the United States. It was double the work because it was very different types of responses to the international versus the domestic and it was a lot of work is what I will say—a lot of work, many, many hours.

Q; Many, many hours on the phone, many, many hours. What is your work entailing in like July, August, September?

Delaney: So the initial ramp up was a lot of document review, preparedness outreach, coordination. I think it was, again, determining staffing, trying to find and get resources and people where they needed to be, both domestic and international. We were starting to deploy NIOSH staff abroad and preparing them and understanding what those requirements were. One of the challenges that we have at NIOSH is that most of our staff, we only have probably less than one hundred people here in Atlanta and they're not the technical staff that would deploy anyways. We have an extra component of trying to get them from their duty stations to Atlanta to get the training, to get the PPE, the equipment, all of that. So there is an extra piece of hand holding and coordination that has to take place for us that kind of complicates a deployment. It was a steady pace and it was trying to educate our NIOSH leadership on the issues and what the needs were and then bringing my staff more into the fold. At first it was just me and then you realize very

quickly you're overwhelmed and then you have to start pulling in and then really what has to happen is you have to make that decision: okay, the day job has to go away. This is a reality. We can't work on the Ebola response during the day and do our day jobs at night when we go home. This Ebola response, we're at the critical point where we have to just push everything aside and we're only working on Ebola. Once you're able to make that decision, it's fairly liberating because then you are able to focus on Ebola and get that work done and you're not having to juggle. You're still juggling, but you're not at least juggling Ebola work rather than all the other work that you're doing. Unfortunately, you have to set it aside and that's hard to do, but you have to make that decision and move forward.

Q: So tell me what happens then.

Delaney: Well I think the really pivotal thing that happened that really was a game changer was when we—well two things. One, when we had the medical evacuations of humanitarian workers who were infected with Ebola and they were medevac'd to Emory. That I think really raised awareness in the US that wait, this isn't just a problem in Africa. This could be something that could hit us here. And then in October, we had the imported case in Texas where a person with recent travel history into West Africa became ill with Ebola and then that transmitted to two healthcare workers who were treating him. That was a game changer. That was—things have to be different. We have to change how we're responding domestically. That's when the monitoring and movement guidance came out on how we're treating travelers who are returning from

Ebola-infected countries and they stood up screening and monitoring for the twenty-one-day period upon their return. We had to be responsive to the airport workers who were working, customs and border patrol and all of the public health workers who were involved with screening. We also had to change the healthcare worker guidance because it was recognized that the current infection control guidance wasn't adequate to protect healthcare workers. We had a very short turnaround timeframe for drafting new guidance.

Q: Can you tell me about the old guidance and why it wasn't sufficient?

Delaney: I think that the symptoms of Ebola when you have such large volumes of fluid that can [be potentially contaminated with a virus is] really just remarkable and really unheard of; and I'm not a clinician, but just in what I'm hearing. And so the sheer volume of exposure, and the previous guidance did not recommend full body, full skin coverage. I think there were a lot of issues with training and what we call donning and doffing, which is putting on and taking off personal protective equipment, were very risky activities that could lead to potential exposures to healthcare workers if not done properly. So I think it was a combination of needing to improve the type of PPE that we recommended, but also the training component was so critical, that healthcare workers are not used to taking such care in the removal of the PPE. That was really an emphasis of that new guidance that was issued on October 20th, that we had full skin coverage with PPE, but also training—very comprehensive training and the incorporation of what we called an observer, who would actually watch that person don the PPE, make sure they did it correctly and then be there helping them through the doffing process. That really

made a difference because we didn't have—we had one other imported case in New York City and the healthcare system felt very confident and there wasn't that panic of oh no, we've got a case, what do we do, because they had done the training. They knew what they needed to do and there was a lot of confidence around caring for that patient in a safe way.

Q: Just zooming out for a second, when is it that you go to Sierra Leone?

Delaney: I went to Sierra Leone in April of 2015.

Q: April 2015, okay. So you're working on the domestic side of the response up until then?

Delaney: Well, no. We actually were working both. Our office, we coordinate all aspects of the NIOSH involvement in the response, so that includes developing guidance documents, reviewing documents that are generated by other teams in the Emergency Operations Center, webinars for communication purposes, deployment. So we had deployed staff both internationally and domestically. We had NIOSH staff in Texas. We had NIOSH staff deploying to West Africa. We had NIOSH staff that were on the hospital assessment teams that were going out across the US to meet with hospitals that were willing to receive Ebola patients to make sure that they were ready and prepared. Ultimately, we had over two hundred NIOSH staff deployed, some of them deployed multiple times. And we generated more than—this is just NIOSH-led—more than twenty

communication products. That ranged from interim guidance—very technical interim guidance—to fact sheets to online trainings. Yeah, I think that was it. Fact sheets, interim guidance, websites and online trainings. We also worked with CDC on their own internal deployment process.

So NIOSH, we think of ourselves as helping workers outside CDC and CDC has their own internal occupational safety and health group that's responsible for the health and safety of CDC staff. We work with them professionally, but our mission is outside CDC and their mission is inside CDC. But obviously, when you're sending thousands of people out the door and in any given time you have hundreds of people in West Africa, it calls for more resources. We were able to help staff the internal health and safety group within CDC to help ensure the health and safety of our own employees, and we advocated for the creation of what we call a "safety officer" in-country, which had never happened before. This is a very common position if you look at incident command structure, that you have a safety officer who's responsible for the health and safety of responders on scene. When you have one hundred people in a country and they're going, they're crisscrossing the country and it can be really in very remote, isolated areas or in the city, there's a whole host of hazards that when I was there, and granted it was when we were still seeing cases of Ebola but they were fewer and farther between, my greatest concern when I deployed as a safety officer in April of 2015 was not Ebola, it was foodborne illness. It was motor vehicle crashes, it was security issues. It was really important that you have someone visible in-country that could take on that responsibility, and if someone did get sick they could be the point person to help take care of that person

and get them what they need and make decisions about whether they needed treatment or medical evacuation. How we can provide that support to our own staff.

Q: So you had probably seen problems because that hadn't existed up until that point? What prompts you to advocate for the safety officer?

Delaney: So early on in the response we were hearing back from people who had come back from their deployments that there were issues and concerns and a lot of it was—especially earlier—the people who deployed early at CDC saw things that were really hard to see. People were dying on the streets, their colleagues that they were working with one day were being diagnosed with Ebola the next day. There were some security and safety concerns about how they were traveling into the bush by themselves or with teams, and so based on that information, CDC decided to create a more robust program. I'm really proud of what we were able to create. It was really remarkable about both pre-deployment, all of the training that you received and training materials and hands-on training, then while you're on deployment you had safety officers that were there—

[interruption]

Q: So you were talking about CDC's internal health and safety program.

Delaney: Yeah. I was really proud of what we were able to accomplish at CDC. It was an effort that pulled together staff from across the different groups at CDC to make it

happen. Early on in the response, we were getting feedback from staff who had deployed to West Africa that there were some problems with their deployments and that they didn't feel safe. We recognized that we needed to improve how we were deploying staff. So this was all coordinated through the Emergency Operations Center, but we created essentially a unit that looked at preparing staff to deploy pre-deployment, during deployment and post-deployment. We had a really robust pre-deployment program that included comprehensive training about health and safety hazards. They offered lunch-and-learn sessions to connect people who were about to deploy with people who had recently returned, so they could really understand what is it like when you deploy and what are some helpful hints. Small things like, how much money should I take? How much cash should I take? Recognizing that when you go to Sierra Leone, that you land and then you have to get on a water taxi, in the middle of the night, in the dark to get over to the other side where the hotel is. So just being able to mentally prepare for certain aspects of your response is really critical. Things were changing so much so getting that from people who had recently returned was really important.

The pre-deployment phase was very important, and not only did we prepare our own staff, we offered sessions for family members and loved ones. It was really easier for us CDC folks to deploy because we're seeing our colleagues do it, so we have a certain comfort level with deploying, but our loved ones did not feel that way. They're seeing you—you're going to a country where Ebola, an outbreak is occurring. Are you going to be safe? What is CDC doing to protect you? So we offered calls at night for friends and families to call in and ask questions from our experts and hear about what to expect from

the deployment of their loved one. It was really I think very helpful in allaying fears and concerns that are certainly legitimate fears and concerns of our loved ones.

During deployment we had the safety officer position and we had plans in place, should someone get sick, that medical evacuation could happen. When folks returned, it was really challenging for them to go from an environment that was so fast paced, very quickly making decisions and seeing such an impact of your work, an immediate impact of your work, to come back and go back to your day job where most of what we do is long-term projects, it's writing journal articles and it's analyzing data and collecting data and so that transition was really challenging for some people. We offered sessions to talk with our mental health professionals through our Employee Assistance Program. We offered volunteer opportunities and we still do that. We have opportunities to go and volunteer on the weekends with other Ebola deployers and responders and volunteers—just fun kind of after-hours meet-and-greets as well. I'm really proud of what we were able to accomplish at CDC and I really would challenge any organization to say that their program was better than ours because we really I think just did a phenomenal job.

Q: Were you working at all with like WorkLife [Wellness] Office and like Rick [Richard W.] Klomp and those people?

Delaney: Absolutely. Rick has been a good friend of NIOSH for many years. We worked with him as he was piloting resiliency training many years ago. NIOSH and several folks on my staff were part of the initial pilot test. That training, I know he was able to adapt

and include aspects of resiliency into training, pre-deployment training was really important. So yes, we work closely with that group.

Q: When would you identify that this support system, this idea of pre, during and post, really starts to get implemented?

Delaney: A lot of that happened in the fall of 2014 and in November 2014, we deployed the very first—well, we deployed two safety officers to Liberia. That was really the first time we had dedicated safety and health staff in-country to provide that support and advocate for that. So we had to work and get support within the country offices for this role because it wasn't something that people really understood what that position could do. There could have been perceptions that we were there to prevent people from doing the work, which is actually not at all the case. We were trying to make sure that people stayed healthy and safe so that they can continue to do the very important work of what we were all there to do, which was stop the transmission and get to zero. The safety officer concept started in November and gained support, so we had safety officers in all three countries I think by the end of the year or by the beginning of 2015.

Q: You had mentioned that there was kind of a model for doing that with other incident command structures.

Delaney: Right. In the US we have a response structure that follows NIMS, the National Incident Management System, and that calls for a very prescriptive way—and it's

flexible, it's scalable—of how we can respond to emergencies. Off of the incident commander is a position called a safety officer, and that person during responses is responsible for the health and safety of employees at the response. So really that was the model for the international response, but this again, this is a domestic system that started in the fire service in California and is not something that's widely adopted in other countries.

Q: I imagine it was a challenge to find ways to make it work internationally.

Delaney: It was very challenging to get acceptance, to integrate into the country office and the dynamics that were happening in the country. I was fortunate to be able to go in April and can share my experiences. It was probably fairly unusual that someone in my position who is coordinating all of emergency preparedness for an institute got to deploy, but I thought it was really important and I did get leadership support to do that. I offered it to everyone on my staff, that if they wanted to go—a lot of what we had been working on was complete at that point, so we had to stagger it and not all go at the same time, but we were all able to have that opportunity. I served as the safety officer in Sierra Leone from April to May.

Q: I want to put a pin on that because I want to make sure we have everything before that covered pretty thoroughly. Another question I had—so it sounds like a lot of these changes that you're making are based on feedback that you're hearing back from

returning responders. Did you have an infrastructure for receiving that feedback or was it kind of informal, you would hear people talk about?

Delaney: I think it started out as informal and then as the response grew there became more formal mechanisms to get feedback through interviews and surveys.

Q: Can you tell me just about some of the important people you worked with, notable people you worked with in like fall of 2014 and early 2015?

Delaney: Well John Brooks, who I know you interviewed, was our fearless leader of our Medical Care Task Force. John was great—really just tremendous perspective and outlook and even though it was a very serious task that we were working on, he certainly kind of brought some comedy and just a little lightness to the response. So the first time I met John, I went in person to a task force meeting and we pretty much were meeting daily basis. Things were changing hourly and there was a desire to get the right information to the right people as quickly as possible. Again, it was just sort of an information flow and we would report out what was happening in our updates on a daily basis, so John sees me in person and he says, "Can I take your picture?" What? This is not normally what happens when you first meet someone. So he says, "I need to have names and faces together." So somewhere in John's Blackberry or iPhone is a picture of me and my contact information that hopefully he hasn't deleted. But yeah, so John Brooks was really, really great. I think he led us through some of the really challenging

times on the domestic cases that happened here in the US and that was a really stressful time. It's getting covered on every news station. It was a really challenging time.

Q: I have one follow-up question coming off of that, which was do you remember any particularly stressful moments?

Delaney: There's so many to choose from. I really felt, even though I'd only been in the position for a year, I had had so much experience that I felt like I had pretty good resiliency and coping mechanisms to deal with the response. Really, it was a workload issue for me and finding enough hours in the day to be responsive and do all the things that I needed to do. I had a really strong staff that were amazing and helped us complete all the tasks that we needed to complete, but we all have our sort of breaking points and so mine came on Halloween 2014. Halloween happened to fall on a Friday that night and like I said, we've talked about I have children and my husband was very understanding and was pretty much a single dad for about nine months around Ebola because I just was working constantly. In his very understanding way he had said, "We are leaving the house to go trick-or-treating at six o'clock. If you are there, great, you can come with us. If you're not, no worries, I will take the kids trick-or-treating." So in my mind, I knew I needed to get home on that Friday night before six o'clock because I wanted to go trick-or-treating with my kids and my husband.

But of course, it's one of those—there's a rule in emergency preparedness that everything happens on Friday afternoons. It's just Murphy's Law. So this week was no different and

we had a short deadline turnaround for our director of our institute who was working on putting together a presentation that he was giving the following week at a pretty high-profile meeting and we felt that we needed to help him and put together information that he needed. It was like five o'clock and we're all in my office and going over these slides and it just was like at this boiling point of I can't take it anymore. I've got to get out of here. Let's do this, let's do this and I got to go, I got to go, I got to go. So driving home, I barely made it, but driving home I had that moment of oh my gosh, I don't know how much more of this I can take. But of course, I got home on time and went trick-or-treating and everything was fine. Fortunately, I think, because we've had such strong experience working in the EOC on past responses, that you really bring that experience and knowledge to the current response and you know what's expected and you know you've built relationships and you understand what needs to be done, then it's not hard.

Q: Can you talk just a little bit more, you don't have to go into detail or anything, about negotiating that—you know, you're away from your family for a while and your husband takes on more responsibilities—with your husband. Also, does he work at CDC?

Delaney: No, he's in the private sector. Well I think I was really lucky that at the time that Ebola happened, my husband's job, he wasn't traveling as much as he usually does and so he was really able to assume more of the home responsibilities like homework and dinners and packing lunches and calendars. I tried to explain to my kids that I'm doing this because I want other kids' mommies and daddies to be safe from Ebola and they really, I think, there was so much on the news that they really understood what it was

about and I think were really proud of the work that I was doing. I did feel a little guilty because just when things were sort of calming down and we were getting into more of a 9-5 pace, rather than a 24/7 pace, right around the beginning of 2015 is when I made the decision to deploy to Sierra Leone, which was a lot of work. It's a lot of work to get out the door to go. It's passports, it's paperwork, it's training. It's more training, it's more training, it's online training, it's face-to-face training, then just what to pack and making sure you have what you need and that took up a lot of time, so I felt really guilty that now I'm finally at a point where I'm having more of that balance back in my life between work and family and I'm leaving for over a month. Not only am I leaving, but in preparing to leave I'm gone more now too. That was a real struggle, but I felt that I really needed to have that international perspective and I'm so grateful for so many reasons that I've gone. One, I think it makes me better at my job because I've seen firsthand how important that role of safety officer is in-country and I've been able to apply and advocate for that moving forward in CDC responses. But also, I think it rounded out my contribution to the Ebola response from a personal level, that I spent a lot of time and certainly the most stressful times for me were not in Africa, they were here in the EOC working on guidance documents and webinars and providing information to the EOC and all of the work that that entailed was orders of magnitude more stressful than going to West Africa and doing what I did. But it just was really professionally and personally rewarding for me to have both perspectives of being out in the field, but also working more on the policy and coordination side too.

Q; Let's dive into your deployment. Tell me about getting there and arriving.

Delaney: I had a really exciting trip to get there. Our flight left on Saturday night, but unfortunately, they loaded us on the plane and decided that we had engine problems and after tinkering with the engine for about an hour, removing the cowling of the engine, they decided, which I agreed with, was probably we should get another plane to go to Belgium, so I was happy after they had been tinkering with the engine for so long. We were delayed, significantly delayed and we missed our connection in Brussels. There are only—at that point, many airlines had pulled out of those countries and were not flying, so you had two flights a week from Belgium to Freetown, Sierra Leone. The next flight wasn't until Wednesday. So half of us were able to get re-booked on a Royal Air Maroc flight to Casablanca the following afternoon. Sunday, we spent in Belgium. Monday afternoon we flew to Morocco and then we had a 1:00 am flight into Freetown from there. Essentially I left on a Saturday night and I arrived in Freetown on a Tuesday morning, so it was two and a half days to get there. We arrived very early in the morning and it was 5:00 am in the morning. It was very dark and the strongest bleach solution I have ever washed my hands in was at that airport. As soon as we got off the plane we had to wash our hands in this very strong bleach solution. I assume it was very fresh, which was why it was so strong. We had a car, a van that would take us to the water taxi.

Q: How does the bleach solution feel when it's very strong?

Delaney: It's very slick and strong and then of course I'm worried like these are the only clothes I have, I hope I'm not splashing bleach all over my clothes because this is it for

the next month. Yeah, and it burns a little and it's just sort of this rude awakening of like okay, here I am and this is my new reality.

Q: So you take the car.

Delaney: We get the car, we get on the water taxi. Our luggage is separate at that point. Our luggage is on a separate boat and you just think, I hope it arrives with us on the other side of the ocean. We get in another car—actually, the sun rose as we were going across the ocean and it was a beautiful sunrise and I was happy to see it, but it was a very choppy ride and there were some people who were not feeling too well on that water taxi. What was really wonderful and one of the things that the safety officers did was greet all the new arriving volunteers and deployers. So my staff—so a person on my staff, I was replacing her as safety officer. She greeted me when we got there and had a big bottle of water for me and said, "Let's go have breakfast and then you need to go get a couple hours of sleep and then we'll start our day and we'll transition." Because unfortunately, she had been there an extended period of time—almost sixty days or maybe even more than sixty days. Really, that's long enough and you really need to come home then.

Q: Can you say who that is?

Delaney: Jill [M.] Shugart. I was bound and determined to not add any extra days even though we lost a lot of time overlap being in Sierra Leone because of my flight delays it would have added three or four more days because the next flight out. She was on the

Thursday flight and I didn't want to ask her to stay until Sunday because she'd been there for so long. So we had about a day of transition of what she was doing and you're jet lagged and you're just trying to take it all in and you don't take any of it. You're trying to absorb as much as you can, but I know looking back I was missing half the conversation. It was just so much going on and I remember feeling there's so many people, new faces and how will I ever get to know all these people to be able to support them and do what I need to do as part of the response? It was really kind of overwhelming at first to say, this is what life is going to be at for the next month or so, but I sent her off the next day and started on my own journey as safety officer in Freetown. I like to equate it as CDC, Sierra Leone University. I felt like I was back in college almost because we were all living in the hotel, the Radisson [Blu Mammy Yoko Hotel], which was like a dorm room because we were all eating in the same restaurants and eating breakfast in the same places and we were all working. It was like finals week—that energy that you have during finals in college where everyone is just cramming and just that energy that you feel. It was like that for the entire month. The camaraderie and the friendships that you built, it reminded me so much of being in college where you're living and you're working all within this kind of little isolated unit. I like to say that I graduated from CDC, Sierra Leone University.

Q: So tell me about the first few days of work and getting acclimated.

Delaney: I remember the first night going to bed thinking I don't think I'm going to like this, but I know I can do it for a month, but I don't think I'm going to like it. Actually,

that was a feeling that went away almost immediately. It was really new. Obviously, a lot of different moving parts. One thing that had actually raised an awareness about myself that I didn't know is how much I liked working in teams and then being a safety officer, you're really a team of one. So I felt a little isolated in terms of professionally what I was doing on a day-to-day basis because I was a team of one and trying to integrate with the various teams that seemed to have more of that team group spirit. You build relationships and friends and I felt like as a safety officer there was sort of a social component to what I was doing there because I wanted to hear and I wanted people to be comfortable to tell me what was really going on. I wasn't the safety police and I wasn't there to get people in trouble, but I wanted to know what people were doing.

We put together training, so I slowly got the rhythm of the staffing rhythm and the expectation of what we would be doing or what I would be doing while I was there. We had two groups of people that came in on flights twice a week and the first thing they had to do—they would arrive at night and the first thing that they did the next day would be sit through several hours of training and one of the trainings was my health and safety brief about what to do. They'd already had training in Atlanta, but this was more specific to Sierra Leone. It complimented what already had been given to them in Atlanta.

I coordinated with the US Embassy and the security officer, the regional security officer in the embassy. So the vaccine trials were really taking off and that was a big activity that was happening while I was there and there were large crowds and so there were concerns about the crowds of people that were arriving at the vaccine sites to be part of that study,

so we worked with the regional security officer at the US Embassy to work with the local police to ensure that there were adequate police.

I tried to do a lot of education about food safety because pretty much if you didn't get some kind of foodborne illness you were pretty lucky. I mean that was almost like a given that you were going to have a foodborne illness, and we wanted to know about it so that we can maybe trace it to a certain location or a restaurant and try to let people know maybe not to go to that place.

I was really worried about staff resiliency, so trying to make sure that they had what they needed. Sometimes they would deploy and for whatever reason medications would be lost or they didn't have the medication, some of the over-the-counter medication that they needed we kind of kept stashes. The area that we worked in was affectionately referred to as "the Cave" because they had no windows. We tried to keep and manage supplies and equipment and I made kits, personal protective equipment kits, so that if there was a medical emergency onsite that we had the right equipment to keep people safe and be able to respond to some of the first aid issues that popped up. So it was really a variety of things that we did. I tried to spend some time, but one of the challenges was I was a team of one trying to cover what was happening in the districts because we had teams that were traveling to the districts during the week, but we also had staff at headquarters in the Radisson. So, trying to cover the whole country was really challenging and understanding what the issues were up-country for those staff was challenging. I did some day trips to look at those staff, especially the vaccine locations because we hadn't looked at them

before to make sure that those facilities were safe for our folks. So that's one of the many things that I did while I was there.

Q: Were there unique issues that you found with people who were deploying out to the districts?

Delaney: Yes, because their hotel and their availability of food was different and probably more suspect than ours, so some of it was a food issue. Some of it was the hotels that they were in, there were issues with running water in the hotels. Some of the hotels didn't have running water. They got a bucket of water instead of a hot shower. Many of them had to find local families who would cook for them and so we didn't have a lot of confidence about how safe the food was, but that was their only choice. So we just tried to emphasize using bottled water; don't drink any water that's not from a bottle; eat warm food; don't eat freshly cut up food because there's potential for cross-contamination with contaminated water; things like that.

Q: How did your work kind of change over the—you were there four weeks?

Delaney: Yeah, thirty-four days, but who's counting. One of the things that really changed what I was doing—we didn't drive. We had a pool of drivers that provided driving, getting us transportation from one location to another. The drivers would congregate in the parking lot of the Radisson and meet and then when we needed them we could just go out to the parking lot and we would get assigned a driver and then that

driver would take us to different places. A lot of times, drivers would pretty much be dedicated to that one person or that one team for the entire time they were there. We had one evening, one of the drivers, a very beloved driver for the vaccine team was found unconscious. We had to get a team together and pull together personal protective equipment and had two of our physicians don PPE. I donned PPE as well to help provide support to them as they were—I wouldn't say caring for him, but trying to turn him over and wait for the ambulance to arrive, which in Freetown it's not the same as our 911 system, so it took many hours for them to arrive and take him to a medical facility I'll say.

That really I think changed our thinking of what we needed to do because I don't know that we necessarily expected that to happen. We did learn he passed away in the night unfortunately, and it took a couple of days to get his laboratory results back whether or not he was Ebola positive, but he was Ebola negative, which we were fairly confident he didn't have Ebola because the drivers do monitor their temperatures and he hadn't had any symptoms. But it's always reassuring to get the actual lab results.

Q: That's a very intense experience.

Delaney: It was a very intense experience, yeah. But what grew from that was the compassion. He had really touched so many lives that people back here in Atlanta that had worked with him in the fall—they sent sympathies and wanted to donate and so we were able to have a couple weeks later a service and invited his family to attend and then

presented them with a donation from all of the CDC deployers—a pretty significant donation to help his family, which was really, it was wonderful to see us come together and really appreciate the people in Sierra Leone for all that they did. But it also opened our eyes that we needed to have some better protocols in place to respond. I worked on developing having more robust first aid kits available in the Cave. I managed and we had been waiting for an AED, the [automated external] defibrillators arrived. So I set those up and then I created kits, so that they could sort of like be grab-and-go standing kits, so if this happened again that staff could grab them and be prepared because they hadn't been packaged that way before. We had PPE, but it just hadn't been— when you quickly need to put PPE on you just need it packaged differently. So I created these sort of grab-and-go kits that were available and made sure that we had all the information on preparing for the decontamination and the doffing of the PPE. We didn't really have that kit put together, so I put that together with all the material of how to prepare the solution so that if we had to put the PPE on we could doff safely and then do the hand hygiene and all that goes into what happens when you take off PPE.

Q: Did you see these changes being implemented and having a real effect?

Delaney: Well fortunately, we didn't have any other real medical emergencies afterwards, but certainly we knew where it was and it was available and very visible and people knew where to go should it happen again.

Q: Is there anyone who sticks out in your memory working with them or helping someone?

Delaney: I think from my standpoint one of the epi [epidemiology] leads was Cynthia [H.] Cassell and she was one of the folks that worked in headquarters in the Cave full-time like I did and we really struck up a friendship while we were there and kind of were a support group for each other. She was just a really funny, fun person and she just has this really great laugh that when you're having a bad day and you can go back at the end of the day and have dinner and decompress, it was really nice. She's sort of to me a model of what has occurred with one of the great benefits of this response is that people who'd never really thought about working in global health—this really changed her career. She went from working in a center that does no emergency response. Now, she switched over to global health and is working still today on the Ebola response and spending some time between here and West Africa. She's just really sort of a model for how Ebola has really impacted people's careers at CDC and had—really changing their career path from what they thought they were going to be doing to something different.

Q; Is there anything else you want to talk about, about the deployment to Sierra Leone before we come back to the United States?

Delaney: No.

Q: Okay. [laughs] So tell me about coming back.

Delaney: Coming back was awful. As the head of my office, it was hard for me to be out for that long and not be supportive of my staff. So when I came back there were a lot of things on my to-do list—to manage just day-to-day issues that came up while I was gone that I couldn't address until I came back. What made matters worse is that I had previously committed to giving presentations and attending certain conferences when I came back and they were all sort of happening as soon as I returned. And so there was a lot of pressure to get presentations done and the workload was just pretty high and for me, even though we do have some respite days, so you're able to take some leave when you get back, I actually only took one day off before I went back to work just because there was stuff I needed to do. Really, I think I needed a few more days to decompress. To me, it was less stressful working in Africa than it was coming back and having that transition back to all these people needing something from me and trying to take care of my own personal responsibilities of having to put these presentations together. And then top of that we had another emergency pop up related to anthrax and laboratory contamination in different labs, potential contamination in some labs. We had to deal with a whole new emergency on top of Ebola, on top of regular work, so I was just feeling really overwhelmed. It took me a good month or so to feel back on top of things.

Q: So I imagine that Ebola as the disease, as you get more infrastructure set up and as the disease progresses, you're able to re-take-on a lot of your daily activities that you had to abandon?

Delaney: Yes, right. We're still doing some Ebola work here and there, but yeah it was sort of a slow transition over the summer where we were able to pick up and try to remember what it was we were doing the previous year. That's sort of challenging too is to pick up projects that had been pushed aside for a year or more. We're still I think trying to grapple with getting our office back into a normal non-emergency response rhythm because we had been in that response rhythm for so long. That was what was so unique about Ebola, just the duration. Most responses it happens, you're quickly moving to recovery, and with Ebola it was a really sustained response for a very long period at a very high level of response and that takes its toll.

Q: So bring me up to now.

Delaney: Well Zika. Zika is the new response now and of course it's very different, but we're pulling together and using a lot of the models and approaches that we utilized in Ebola and are applying them to Zika. It's a lot of the same people unfortunately, because I think people are pretty tired and need to do their day job, but we've got these really important emerging infectious diseases that we can't ignore. So Zika's taking up a little bit of my time, but I'm actually getting back to my day-to-day jobs, all those different projects that have been set aside. Hiring new staff, so I'm interviewing folks this week to hopefully make an offer to bring on a junior staff to our office to help with—and a lot of what that person will be doing is taking some of our protocols that weren't written down, but we'd like to have written down on how we respond, and put those in writing to help us. We're still doing after-actions for Ebola believe it or not. We had one yesterday and

we have one coming up later this month. So there's still some work to be done to process what happened and how we can take what we did and apply it to future responses. We're still learning from Ebola and how we can do a better job the next time around.

Q: What do you mean by "after-action?"

Delaney: After-action is a way to reflect back on our response and talk about what went well, what some of the opportunities for improvement might be, and then try to actually then do something about what you've observed. It's great to find the flaws or pat ourselves on the back for what went well, but what we need to do is make sure that we take those as action items and tasks and actually incorporate them into how we respond in the future.

Q: Do you have a specific example of something that you were able to do in Ebola that you can now apply to Zika?

Delaney: Well yeah. One of the things that we did really early on in the Ebola response was pull together a team of experts across our divisions at NIOSH and pull them together and talked through, what are the hazards? What are the risks to workers, like what are the issues that we should be thinking about? And that worked really well. One, it engaged our divisions. It got them more invested and aware of the Ebola response. And then we got great information that helped advise and direct our office and what we needed to be doing. We've done that with Flint, the Flint response with the lead water contamination,

and we're doing it now with Zika. We are also being more responsive to labor unions. The labor unions were very concerned about CDC guidance that was issued during Ebola, so we've been meeting with certain labor unions for Zika just to educate them and make sure that they have the information that they need to alleviate fears and concerns and let them know what we know and what we don't know.

Q: We're talking like healthcare unions? Healthcare worker—

Delaney: Well, for Ebola we had a labor union call that included all the labor unions, so they could attend if they wanted. For Zika, we've been working with the Association of Flight Attendants. So they're concerned obviously because they have flights that take them into Zika-impacted areas and what that means for them, especially some of the younger flight attendants who are child-bearing age.

Q: Well looking back on Ebola, on anything else that you've talked about, any final reflections?

Delaney: Just that I was so proud to be a part of this response, and I know that you've probably heard that from everyone that you've interviewed, but it certainly was a career highlight and one that I'll always remember and sort of hold up as one of the great achievements. Even today, in my office we [reflect] back, we're just pretty amazed at what we were able to accomplish. When you're in it day-to-day, you kind of lose sight of it. You're so far in the weeds. But we've had enough time now to reflect back at all that

we did and I'm just so proud of everyone. I'm so proud of everyone at NIOSH. We don't have a huge group of infectious disease experts, but we have very specialized expertise in health and safety, engineering control, personal protective equipment, and we were able to bring that knowledge into the response and I think ultimately helped protect the health and safety of all workers, not just the healthcare workers who people think of were at probably the highest risk, but all workers. The funeral and mortuary workers, airline workers, decontamination workers. I think we helped raise awareness that those groups are important too and we're going to apply everything that we learned to all the future emergencies.

Q: Okay, thank you so much Lisa.

Delaney: Thank you, Sam.

Q: Appreciate it.

[break]

Delaney: So I wanted to mention I think a big role that we played during the response at NIOSH was bringing our personal protective equipment expertise into the response. We have a laboratory in Pittsburgh that was able to do research and evaluation of different personal protective equipment that was being recommended and learn about which personal protective equipment, PPE, was most protective and best for our responders. So

for example, a couple of things that we did. MSF, Doctors Without Borders, had concerns about the PPE that they were requiring their volunteers to wear. It's not breathable. Sort of by virtue of what you want it to do to protect you from fluids that might be contaminated, it doesn't breathe, and so there's a tremendous amount of heat stress that it places on the wearer. They had asked us to look and evaluate if there were other types of PPE that might be more breathable or comfortable for workers and then for how long it might be tolerable to be worn because when you get too hot you reach that core body temperature and it can be really dangerous for the wearer.

We actually have an environmental chamber in our laboratory that can mimic the conditions and the temperature and humidity conditions in West Africa and we have a mannequin that can mimic the human body. It actually sweats and you can measure the—it looks like something out of a horror movie in the pictures. It's very hard to take a friendly picture of this mannequin, but it can mimic the human body. We were able to put different types of PPE that was recommended by different groups and challenge it with this heat in the environmental chamber and look at about how long it could be worn before that critical core body temperature was reached. What was interesting is that it mimicked—what we found was about forty minutes, and that mimicked very closely with their guidance and what they were recommending during the really high season. So we actually had the data to prove that, which was great.

One of the things that I think was misunderstood or really not recognized and I know I certainly didn't recognize it to begin with—I know a lot about respirators, but I don't

know much about gowns. You just think you grab a gown, you put it on and it works, right? You go to the doctor, sometimes they're wearing gowns, but not all gowns are created equal and so we had a gown expert.

I can't pronounce her name, but Selcen [Kilinc-Balci], she was our gown expert. We were able to tap into her very early in the response to share with us how gowns are evaluated and assessed and would they protect against Ebola. That was not included in the initial healthcare infection control guidance for protection against Ebola. With additional work with that group, we were able to issue guidance in the fall very rapidly. Technical guidance that was not specific to Ebola, but just generally outlined how gowns and coveralls, which are more of the bodysuit, like a gown just goes to your knees and ties in the back, but the full kind of what you think of as like a Tyvek suit that zips up the front, those are what we call "coveralls." So we put together a guidance about the different test methods of how those gowns and those coveralls are tested for their permeability to different fluids. There's a variety of different tests and test methods both domestically and internationally, so it was a very complex topic that we were able to sort of whittle down into a guidance document to really help people understand how these gowns are tested and to help guide selection. I think we got feedback from manufacturers that have said, yeah, that's the best I've seen it written up because it really is such a complex topic.

We spent a lot of time educating CDC leadership about how to recommend and how to include the correct PPE recommendations into CDC guidance and we briefed the incident

commander as well as Dr. [Thomas R.] Frieden on this and got it incorporated into the guidance. So I think that was actually one of our great success stories is that we did raise awareness about issues that you can't just say a gown because that's not acceptable. That's not going to really help the response. We also recommended and consulted with the Strategic National Stockpile who were acquiring PPE as a stockpile for hospitals domestically who might be receiving patients. If they didn't have the proper PPE then they could request it through the stockpile. We also ensured that the CDC stockpiled the appropriate PPE as well. Again, I think that was a very important component of what we did at NIOSH to help, again, ensure the best PPE was recommended.

END