Kevin De Cock, Kenya

Director of US Centers for Disease Control country mission Kenya. Served as team leader for CDC response to Ebola epidemic in Liberia through three tours of duty in 2014 and 2015.

K D C: ... the border with Guinea, the border with Guinea and Sierra Leone. A short while later, somebody from here, a colleague of mine called Joel Montgomery went to Liberia for about two weeks for what we call … well to provide epidemiologic assistance. Investigate the outbreak, set up some training for control and so on. Joel was there for about two weeks, there were some others, I think there was someone else from CDC as well and the outbreak seemed to be finished, there were no more cases, but then there were cases again notified in late May, mid to late May and then it really started. Now I happened to be … in June, late June I happened to be in Atlanta … I was going to Atlanta, and I just had correspondence with colleagues back in CDC saying, "What's going on in West Africa? What are we doing? It seems to be quite serious." CDC was involved and there were people in the field, particularly in Guinea I think. But I was back in Atlanta late June, early July, and I talked to various people and just at that time CDC had received a request for assistance from the Minister of … from the Chief Medical Officer in Liberia, and folks in Atlanta dealing with all this said "Well fine, do you want to go? Can you go? Can you to Liberia?" So that's how I got involved.

MH: *So you were in Atlanta when you were having those conversations were you?*

K D C: Yes yes, I was on a short-term visit to Atlanta.

MH: *Right. Okay, can we get to that in one second? The question I wanted to ask you which is pre-dating this, I'm quite interested in what your perception of Ebola was before this epidemic. In other words, there'd been, I think, twenty or more outbreaks of Ebola since 1976, all of them in Africa, but in a different part of Africa. How did you view Ebola? Did you see it in these rather colourful, if I can put it this way, Hot Zone terms, this potential scary biological warfare agent, or was it just another endemic tropical disease, albeit one that if it got out of hand could have quite alarming consequences? Where was it on the spectrum between* [? 02:54] *tropical disease if I can put it that way, and something like an epidemic or pandemic threat?*

K D C: I'll answer that; actually I should refer you to a paper we wrote based on my first deployment from mid-July to mid-August. We published a paper in emerging infectious diseases entitled, it's exact title I can't quite remember, but something like 'From exotic infection to global health priority'. My view on Ebola before was, I think, pretty sanguine and objective. An African infection, an infection … essentially a zoonotic infection in the sense that it's natural reservoir is in animals, presumably in bats, that we know can cause outbreaks in animals and then in people who come into contact either with the source or the reservoir, or with secondarily infected animals, and can cause, you know, bigger or smaller outbreaks. There have been about, as you said, there have been about 25 recognised outbreaks, with a total number of cases of about 2500. A very serious infection with a case mortality rate with anywhere between about 30 to 90 per cent in different outbreaks. And it's an infection that I had no direct experience with it myself, but I knew a fair amount about

it because of my EIS experience and having read a lot and having talked about it in previous jobs. What was different about this, when I started talking to people saying, "What's happening? What are we doing? Are we visible enough in all this?" What was different was firstly, it was further west than it had ever been because the furthest west that Ebola had ever been found was in the 90s, when the Swiss veterinarian got infected in Côte d'Ivoire after doing an autopsy on a chimpanzee who'd died. And she got infected, she survived. That was the furthest west it had ever been so here we have it really very far west. Secondly, it was affecting three countries at the same time, that was completely new. And thirdly it was involving … it was located in their capital cities, so all of that made me think, "My goodness, this really is quite something." And by that time the total number of cases was really still quite low, we're talking about June or so, that was a year ago. That was my perception. My month … my first month, that first month, mid-July to mid-August really was an extraordinary month, when literally every day initially or every couple of days, something would happen that just made you sit up and think "Oh my Lord!" And that really it was I think, like I said in that talk you attended, it was events in Liberia more than anything else that really put this whole thing on the front pages of the newspapers, at least initially.

MH: *Are you saying that you radically had to change your own perception about Ebola on that first tour of duty?*

K D C: It wasn't so much that I changed my perception of the virus, but that we were seeing things we'd never seen before. There were two or three things that really were dramatic. One was the severity of the epidemic, I mean the fact there were only two Ebola treatment units in Liberia when I arrived there, and over the space of a few weeks they were completely overwhelmed. They had to turn patients away. We had patients dying in hospital grounds, or sometimes in the streets. Or people dying in their houses and not being collected and so on. There was just a very … people were frightened and it was very uncertain where all this was going.

Secondly, around July 20th or 21st, we had the case with the Liberian Patrick Sawyer, who, a very highly connected individual, I think he was a dual citizen, American and Liberian. Very well connected politically, he had contacts with the Presidency and so on, who travelled to Nigeria and set off that secondary cluster in Nigeria. So here we have everybody's worst nightmare which people had talked about since the '90s when we started talking about emerging infections and when the term was first coined, and we started talking about the international spread of infectious diseases and so on. Here you had exactly that. Somebody gets on a plane, ends up in another country and sets off a secondary outbreak. And then just a week after that, actually less than a week, a few days after that, we got involved with the infections in these Americans working for Samaritan's Purse, the faith based organisation. And that had never happened. These were the first infections in US citizens and we were there and investigated that cluster of infections. So it was a very intense experience. I'll come back to … if you want to come back to EIS in a minute because I had several EIS …

MH: *Can I just quickly stop you there because one interpretation of what was going to happen in order for the world to wake up is exactly … other people had identified these events, the fact that Patrick Sawyer the diplomat travelled to Nigeria, to Lagos which is really a mega city, and then also the introduction of the virus to American citizens who then come back for treatment. Is this … what I'm trying to ask you I*

suppose is is this what was necessary in your view to wake the world up to the sort of severity … you alluded to the fact that there have been in the past, scenarios around emerging infectious disease … they do training exercises. These scenarios were kind of run through. So, I mean, one interpretation is that it was only when Ebola became a threat, not just to global health security, but specifically to the security of the United States, that we saw a marked shift in the responses to the epidemic and the galvanisation of constituencies that was necessary?

K D C: I think the explanations are plausible. Certainly the United States … attitudes changed in the United States very understandably as indeed they have done in the United Kingdom when UK citizens got infected in Sierra Leone. But this was all … it was these events, plus the severity of the situation that over the course of a few weeks literally changed global perception of this from some kind of obscure virus that you read about from time to time, and we knew could cause outbreaks and serious and frequently lethal infections, all of a sudden, is actually an issue for global health security and is being discussed on the floor of the United Nations and at the Security Council. Really quite remarkable. And all of that happened over a very short time.

MH: *Yes. Continue with your chronology because I think you were talking about other things that were happening to you in that first tour of duty. And I was struck in the talk you did at the London School of Hygiene and Tropical Medicine you were describing the systems the* [? 11:58] *had put in place with the National Ebola Task Force. So if we can divide it up and can talk about the period in July to August, so I'm trying to understand more how you are drawing on your training in EIS and were able to help mould the command, the control operations and the response to the outbreak in Liberia.*

K D C: Yes, I'm a clinician, my original background, many years ago. And there's actually an analogy between how you approach an individual patient, especially a critically ill one, with how you approach an outbreak, because you ask them certain basic questions, but then when you actually start reacting you're actually doing many things at once and it can appear slightly chaotic, or it can become chaotic if you're not systematic about it! The first question in an outbreak is "Is there an outbreak?" and if there is, is it due to what you think it is or what you've been told it is? So … and then certainly describe it in time, place and person. Who's affected? When were they affected? Where are they? And we set about all of that, just trying to assess the situation, describe its severity and communicate that as we start figuring out what to do about it.

While really … initially you go and look around and you get caught up in these individual stories, like one thing we had "Is it Ebola?" Well we had to figure who is doing the testing and where is the lab? And one of the first things the Ministry … when I went to … when I arrived, one of the first things I did was to go and see the Minister of Health, an older man called Walter Gwenigale, he's actually a surgeon who is in his mid to late 70s. He actually didn't know how old he is, because he didn't know when he was born and he made up his own birth date! He had to fill in a form once to go to the United States and he asked his mother when he was born and she said she didn't know, so he just put an arbitrary date! So I went to see him and he … things happen that you remember and you think "Okay, that was important." I had sort of jotted down some thoughts and so on and started explaining them to him, and then he very very gently, very politely sort of tapped me on the knee and said

"Can I tell you what we want?" [laughs]. I thought "Well done." I thought to myself "You idiot, that was presumptuous." [DeCock clarification on preceding passage: *I am not sure this comes out clearly. What I intended to convey was that I had been presumptuous in intending to give advice before listening. The "You idiot, that was presumptuous" was meant to be towards myself, and the "Well done" was me to the Minister, recognizing he had been skillful in his gentle remonstration.]*

And of course he was absolutely right. But one of the things they wanted from CDC, and this was actually interesting because it's one of the things I think we need to think about as an organisation when we evaluate how we did, he said they wanted help with the laboratory. Now we didn't have a lab team with us – I'm a physician epidemiologist, we only had epidemiologists on our team, we didn't have any lab personnel. So we none the less played an important role coordinating lab work and trying to fix things around personnel and supplies and diagnostics and just making sure the right people were available and stuff like that. The lab was actually being run by the technical advisor to the laboratory … was being given by somebody from NIH with a colleague from the US Army Medical Research Institute on Infectious Diseases the [? 16:04] We were able for sure …

MH: *I think that was Joseph Fair wasn't it?*

K D C: Not at that … When I was there … I know him, it wasn't him at that time. It was a woman called Lisa Hensley and a guy called Randy Shilts. Lisa's from the NIH and Randy was from USAMRIID. Anyway, long story short, the collaboration was very very good and we all understood each other and they did great work, and I had their back at the Ministry. So …

MH: *So at this stage, just so we're clear, CDC has been invited in in an advisory role, how much latitude do you have at this stage to make decisions? Is it all done consultatively or how does it work?*

K D C: [laughs] Absolutely it's … you're there to give advice, it's not your country. And diplomacy is a very important part of all of this, making sure you figure out how the system works and where you can apply pressure to get done what needs to be done. I think we were very fortunate, I mean it worked. They … in fact I do want to commend the government of Liberia because I think they have shown throughout this outbreak, a very skilful mix of being in charge, and there's no question about who's in charge, but at the same time accepting advice and showing quite considerable flexibility. And I think those three things - their being in charge, and their direction with flexibility and with the ability … flexibility meaning they would change direction when it was necessary, and when I say direction I mean how things are being done or where they are going. And certainly being able to accept advice – [? 18:22] advice and acting on it. That's I think one of the reasons why they did get on top of this problem. There are many other reasons also. So you know, it's … I think CDC was fortunate in that we got it right when we were first there. But the name carries a lot of weight and Liberia's relationship with the United States is a very special one. I think we had a … in fact it's one of the fascinating things of this outbreak is the relationship of the individual countries with their own partner countries in the industrialised world, in the high-income world. [?So I don't know if it works 19:07] And the CDC was always at the high table from the beginning.

MH: *Right, so you were in a position to offer your expertise and advice early on, but can we just focus in a little bit … what I'm trying to understand is what we saw, what I saw and what other people saw sitting here was of course those terrible scenes in August when there was a lockdown at West Point, and that seems to be a crucial point where these harsh, sort of coercive measures were kind of backfiring and not working. Can you just describe in the run up to that … I mean I take it that was the decision of the Liberian government, but were there debates going on about how to manage community engagement at that point? Or is it those scenes that force the kind of reckoning and change of direction?*

K D C: Let me answer two ways. Firstly West Point happened shortly after I left. I left on the 15th or 16th August and West Point happened just a few days later. There were debates happening before that – at many different levels and also in the Presidency, in meetings with the President about what kind of … about two aspects, firstly, what kind of care could be given if there are so many patients. Because, you know, the traditional model of an Ebola treatment unit à la MSF is really quite intensive with five to ten people required per patient in terms of physicians, nurses, hygienists, cleaners, etcetera. And the provision of intravenous fluids is taken as a given. Now, with this many patients and shortage of staff, and people really burning out, we argued that you can't do this. We've got to think of lower levels of care, simpler levels of care, that still meet some definition of care, but satisfy the need for isolation of sick patients.

And we argued it's really pragmatism, not that this is ideal, you use what you've got and you do the best you can. And a lot of people have difficulty accepting that. And that caused a lot of debates and a lot of anguish on different peoples' parts. There were also discussions about restriction … so anyway, that concerns isolation of patients and care of patients. There were then discussions of quarantine and restriction of movement. Quarantine refers to people who are well. And we had started screening at the airport, but they are also beginning discussions about actually isolating, or rather quarantining, areas of the country and restricting movement.

And those were never very public discussions and communities started taking action of their own, like in lots of counties certain villages imposed isolation and quarantine themselves. Anyway, all of that led up to West Point where I think the government recognised once the riot happened and the unfortunate boy was shot, they recognised that this wasn't tenable and reversed their position quite quickly on that. Again, an example of the flexibility they showed.

MH: *Okay, right. Maybe we could talk a little bit now about what models of management of this outbreak you and your colleagues were able to draw upon. I suppose I'm particularly interested in a way, in this respect, of the Epidemic Intelligence Service, which my understanding of it history is it was initially conceived as a sort of* [? 23:49] *disease detective. And increasingly become involved in these more logistical commander control operations. And of course, once the* [? 24:00] *would be polio eradication efforts in Africa. Could you talk a little bit about the context here of commander control and how it's been applied in this epidemic, how involved in this epidemic?*

K D C: Before I do that, let me comment on what you just said about EIS, because I'm not sure I see it that way. The EIS programme did start in early 1950s. Actually one of its original reasons for being set up was to detect threats from biological warfare should they occur. But quickly sort of changed into an outbreak response outfit focussing initially on infectious diseases. And really it's been known for … the person who set this up, Alexander Langmuir, was sort of recognised as the father of EIS and the [? 25:05] of response capacity for outbreak investigation and control. But also, for the concept of disease surveillance - the routine collecting, the routine monitoring, data collection and description of disease distribution and analysing those data and communicating to those who need to know. Those two activities, I would say, are the backbone of EIS. Over the years, the programme has grown and you find EIS offices across all of CDC including in non-infectious disease work and out in the States in the Health Department, but the responding to outbreaks remains a very central and expected duty. So it's perfectly logical that they get involved this particular outbreak. I mean, over the years … usually outbreaks are much more limited and people work on their own … concentrate on their own area of expertise, or if something big happens they go and help, the example is we've got two or three EIS officers here working with us now in Kenya right now working on cholera, there's a cholera outbreak going on. But sometimes when something really really big happens, I mean, three examples, the anthrax attacks in the early 21st Century, the epidemic of fungal meningitis a couple of years ago in the United States from nosocomial transmission, [? 26:48] injections, and then this Ebola outbreak. These are unusual big events that then people get drafted from across the agencies. Anyway, so that's how EIS is … just some comments on EIS.

In terms of your question about command and control, one of the things we did when we first arrived, and my team was … I think there was seven of us who arrived in Liberia around the same time … of whom four were EIS officers. One was a recent EIS graduate … well two were recent EIS graduates, one with expertise in data management, or database, and the other one was just a recently … a general epidemiologist. There were only seven of us. Myself and four EIS officers, and two very recent ones, and one of the first things we did was to go to the so-called Ebola Task Force meeting. And this was a chaotic meeting at the Ministry; it was … there were about 80 people in the room. It was just not a well-run meeting and there was an agenda but it was unclear if notes were taken and how follow up actions were defined. And the next day, the meeting would essentially go over all the same information that would be repeated the day before, and we thought this is not an effective way of making decisions and so on, so we consulted and thought what we really need is a [interruption 28:43] we need an incident management system. And CDC had an emergency operation centre in Atlanta where, when something like this happens, an incident management system is implemented with an incident manager in charge of the event who reports directly to the CDC Director. And we thought, "Yes that's what we need here". I'd never established … I'd never worked with one myself before, but a colleague and I, Satish Pillai, a senior guy on the team apart from myself, we basically consulted with Atlanta, quickly looked up some guidance, and wrote up a scheme for the ministry and went and presented it to the minister and said "Look, we really think this would be a good way of running this." And he accepted it. And in fact … several of experiences apart from in that emergency infections paper, several of our experiences are written up in the MMWR including the establishment of the incidence management system.

MH: *Oh yes, I looked at that, it was very very interesting. At one point in your talk you actually showed your own visits to the field, I think you travelled to Lofa at one point. I'm just very interested if you can reflect a little bit on … I take it presumably*

most of your work is done in Monrovia in these meetings at the command centre? You also get to see it from a different point of view in the field. So I'm just quite interested in the different perspectives and how actually being on the front line, whether you see things differently whilst you actually try to do contact tracing in the community and see some of the difficulties that arise from the point of view of persuading local communities that it's in their collective interest to cooperate and take on board some of the health messages?

K D C: It's always very important in clinical medicine … in an outbreak. It's always very important to actually see what's going on at the field level. And the first thing I did when I arrived, I think day one, the first thing I did was to see the Ebola treatment unit and see who was doing what, and in fact that's … before he got sick I met Kent Brantly, the American physician who was the first to get infected in that Samaritan's Purse cluster. It's very important. The other thing we did was in answering that question, you know, how can you describe the outbreak in time, place and person, I sent people out to the field to every county that had reported cases, just to go and check, you know, what does it look like? Is it bigger than we think it is? And I sent someone to counties that hadn't reported cases to make sure that we weren't missing anything. Again, some of that's described in the MMWR. So it's very important to get out. Actually I didn't get to Lofa County, I tried twice to get up to Lofa county. I had to get up there by helicopter and each time, with the UN helicopters, each time we had to turn back because of weather. So I never got to Lofa County.

There are funny anecdotes both around those helicopter trips and around talking to the Minister about the incident management system. When I sat down to talk with the Minister with Satish, I'd literally just opened my mouth, his secretary came in and said, "We have to evacuate the building, there's a fire." And long story short, there was a fire, and it was quite severe, it was pretty unpleasant getting out of the building in terms of smoke and stuff. And the story was that the disgruntled, perhaps justifiably disgruntled perhaps, but nonetheless, a disgruntled family member of someone who had died of Ebola, tried to set the building on fire. In fact destroying the conference room where the giant meetings had been held. That was one story.

The story about these helicopters was that these were Russian helicopters that the UN I think had on contract or on loan, flown by Ukrainian pilots. And you sort of thought "Wow, how reliable is all this?" And actually the second trip we made, when again we got … we actually did get to Lofa and couldn't land so had to fly all the way back again, but just before we took off there was a big commotion. I said, "What's happened? Has there been an accident or what?" I talked to the Medical Officer and he said, "One of the pilots just had a stroke." I said, "Not our pilot I hope!" "No no not your pilot!" So these sorts of events are unusual and it was all very very intense in that first month.

MH: *I wanted to ask you actually, about that process that took place at … when the disgruntled relative came in. Was that at the National Ebola Task Force in Monrovia? The headquarters of that? Or was it at …*

K D C: Yes and apparently I think he had attended - because anybody could pretty much come - he had attended a taskforce meeting and I think he'd tried to speak or heckle, and had been asked to be quiet and I think he … that's the story I heard, I'm not sure if that's true or not.

MH: *What was … was this part of the generalised process kind of against the severity of the measures at that point or way they were being applied, how did you interpret it?*

K D C: I never really … I never knew. I think that newspaper articles around it … you can Google it … I don't know what the story was and I don't know his motives, his mental state and so on, but nonetheless, it's a pretty dramatic event at the time. Anyway the … the incident management system was set up, and I think it did make a large difference, although it inevitably over time started growing again. And they then created a sort of inner sanctum which a colleague of mine referred to as the 'Gang of Six' – there was a sort of inner group which consisted of the Incident Manager and his immediate staff and CDC, [? 36:39] and maybe somebody else. And the five or six people would meet regularly, and prepare for the larger incident management meetings.

MH: *So this was sort of like an executive board almost of the … how did that relate to the National Ebola Task Force, the larger meetings where you are reviewing the situation report?*

K D C: The term 'the Ebola Task Force' disappeared and was replaced by the incident management system. This executive … as you say, this executive board was a small advisory group really to the Incident Manager, and like I said, often prepared issues for the larger meeting.

MH: *Okay, I mean … this is something new right? This isn't something that the EIS or the CDC had been involved with before? So you're moulding a new way of managing when you're faced with a budget and a chaotic and fast moving epidemic.*

K D C: Well it existed back in Atlanta because the CDC uses an incident management system when the emergency operation centre is activated. But certainly it was news to me and it was news to Liberia. I think it was the first one to be set up in the epidemic also.

MH: *What I'm plugging onto is how important … so there's a marked contrast as you're aware between the way the tail end of this epidemic has played out, Liberia, Sierra Leone and Guinea where we're not at zero yet. We've got on-going clusters of infection and indeed in the last three weeks there's been another increase. What are the key factors that you think enabled Liberia to get to zero so much more quickly than either Sierra Leone and Guinea where they're still not at zero?*

K D C: It's difficult to give a firm answer about that. I certainly can comment on things that Liberia did well and that I think … I'm not saying they're not in place in those other countries because I've been to Sierra Leone twice, I've visited in early December and in March at the request of my colleagues there. I have not been to Guinea. I talked about the incident management system – I think that was important. I've talked about Liberian leadership – good technical assistance, including from

CDC, and flexibility, because there were several events over the course of the epidemic where things were … decisions had to be made and things were done slightly differently, or innovatively, and it was done. Responding to changes … responding to data. Using data and acting on it. I can give you some examples afterwards. I think the population needs to be recognised as well because they changed. Some things clearly made a difference. In Monrovia for example, they accepted the order that bodies must be cremated. There's a whole story there because in August, there were many dead bodies, they had to be buried. There was a horrible episode when – Monrovia's a very wet city – the water table is very high, it was the rainy system, they were dependent on some excavators that broke down, long story, bodies were buried and then re-surfaced, sort of floated up. It was horrible. There was a public outrage, understandably. And the President decreed that bodies must be cremated. Now this is deeply offensive to the Liberian culture, but people accepted it and it didn't cause any riots, there was some resistance, but basically it was done.

So … people stopped touching each other. Now whether that made a difference or not … I don't know to what extent it happened in houses with sick people, but certainly in general, people stopped touching each other. They travelled less; they didn't go out, so that in certain cases the communities implement their own quarantine and isolation. I went … in November I went to a very rural area where we had staff in the field and I talked to the elders and the leaders who initially didn't believe in Ebola, I could not make them change, they said "We saw people die" and they changed. So the community I think, needs to be recognised because I think in Liberia there was less resistance certainly than in Guinea. [DeCock clarification on preceding passage: *"I could not make them change" – I am not sure this is clear. What I meant is I would not have been able to make them change their disbelief in Ebola before, but what altered their thinking was their own experience seeing the disease and associated deaths*.]

And then I often wondered whether there's some aspects of Liberia's development and geography that are different. In that it's not an easy country to get around in. Now people do get around, because by November or so, we were seeing clusters of infections in different places, often very remote, that were initiated by people travelling from Monrovia. But people did travel. But I've often wondered whether in fact there was less population movement just because the country is so … quite difficult to get around in certainly compared to Sierra Leone. If you look around that area around Freetown, the roads are better, there's much more access to the immediate interior. I don't know whether that made a difference or not.

MH: *That's interesting because the problem in Sierra Leone has become like the circulation in these rural areas and then re-introduction to urban areas from those more remote rural settings. But it's also interesting the speculations about whether the communities did more because it certainly seems to be case from my understanding in Sierra Leone and also Guinea that there's a small subsection of the community who are just very resistant to any of the messages and also very distrustful. You know, contact tracers and international health workers.*

K D C: Yes and that's actually something in retrospect … I wonder if we paid enough attention to community sensitisation early on. If I was …

MH: *Could I ask you about that, because my understanding of the way the overall response was conceived was the priority at the initial stage of the epidemic, when this all came out and nobody knows quite how big it is or is going to get, wasn't really on containment or isolation, and of course the WHO … the official phrase was the 70, 70, 60 plan right? Isolation was in 60 days. But that didn't have an emphasis on the community engagement and public messaging so much. Is that right? Would you see it as something over two phases?*

K D C: Well once the incident management system was set up, it did add a community element to it. Social mobilisation which included community sensitisation. But I sort of … I sort of talk about myself really, but I myself would prioritise all of that more than I perhaps did at the time. Because I think persuading communities, explaining things, that's pretty difficult to do when it's a countrywide outbreak. But it merits a lot of thought, and I underestimated how important it was. That's a personal comment.

MH*: Right. It's interesting because you mentioned earlier, Langmuir and how he originally conceived of disease surveillance. I was looking at a related paper he published in 1963 it was called 'The philosophy of disease eradication' where he lays out one of the first depositions of elimination of moving transmission down to zero in a specific area. But towards the end of that paper he made an interesting comment that seems to sort of anticipate some of these problems, where, and I'm quoting he wrote in that paper "We suspect that the possibilities of local failure are more likely to derive from problems of logistics and of quote, subvertant offence against the morays of primitive people than from purely technical considerations."*

K D C: [laughs] Very insightful for being written in 1963!

MH: *Well it's [? 46:47] because there were technical responses to [? 46:54] but of course it's the social and cultural factors that can't be legislated for. That seems to have been the case in Liberia and also continuing into Sierra Leone.*

I wanted to bring you back slightly if I can to this question I asked you at the outset about Ebola itself and how it was perceived in international health circles. In the talk you gave in London, the London School, you said that one reason why there was such a … one of the lessons was that there weren't adequate health systems in place and indeed you've also referred to the fact that there was no guidance, [? 47:48] facilities, there were no ways of doing rapid tests for Ebola. And in your talk, you link that to the fact that unlike other countries in Africa, there hadn't been a big problem with HIV/AIDS in Sierra Leone, or not as big a problem, and therefore they hadn't attracted funds from [? 48:09] *And indeed probably other agencies, other funding streams.*

K D C: Yes, and in fact we wrote a commentary on this, along those lines in the journal AIDS published about a month ago I think. Early June I think it was. Or late May. I think that's true. I mean, these three countries are at the bottom of the scale. They're in the bottom ten in the world for human development, for economic development, gross domestic product. Literacy in Liberia is about 62 per cent and their health systems, particularly the ability to do surveillance, to mount a response to an emergency, to use data for decision making, and their laboratory capacity and so

on, is very very weak. Liberia … I don't know how many doctors they've got, it's a very small number and of course quite a few died. So I think that's pretty fundamental. Nigeria reacted very briskly to that outbreak, to that cluster of infections. They were helped – CDC gave enormous help in Nigeria but they did draw on resources and infrastructure that they had from polio eradication programme and to a lesser extent from [? 49:50] So if this this had happened somewhere else, in east Africa for example, there still might have been an outbreak but I really don't think it would have gotten out of control they way it did in these three countries. That's speculation of course.

MH: *Well, it's interesting because a few weeks ago I interviewed Jean-Jacques Muyembe who as you know, well I assume you know, is the leading expert on Ebola in the DRC, where they did have an outbreak at the same time in August of 2014.*

K D C: Yes.

MH: *But because they'd had a lot of experience there, it was managed and dealt with … it was contained fairly rapidly. He had lots of insight into this, but I wanted to ask you, I mean, there's always lessons learned, reflection that goes on after these epidemics, but if you're reflecting on your experience, what do you think the principle lessons are both in terms of response in an emergency, but also what might be done in the [? 51:09] outbreak period where that Ebola again sinks down in the list of global health priorities?*

K D C: Well I think it's about systems. There's been a huge amount of discussion for ten years now, about health systems strengthening and whether systems should be vertical, horizontal and all of that. A lot of that triggered actually by the AIDS response. Initially the AIDS response … people calling for scale up and access to treatment and then stepping back and saying "Well this is too vertical, really we need to be integrated and so on." I think CDC's position on this in general is the following: firstly, health system strengthening is a very broad topic and what we concentrate on is strengthening surveillance and health information systems, strengthening laboratory capacity. Investing in the workforce, particularly in epidemiology training and the ability to work with data. And then in operational research. Ensuring that data are used and lead to decision-making and play a central role. We focus on all of that to strengthen programmes and strengthen infrastructure.

We tend to believe in this discussion, I think most people at CDC, including our Director, would agree that you strengthen systems by doing something, not by talking about how you strengthen systems. And you've got to have something … you've got to start with something to strengthen and it almost doesn't matter whether it's the immunisation programme, or the TB programme or the Ebola response, but use that as a system … an initial stimulus to developing the things I've just talked about. To me that's one of the big lessons. And I fear that that is required more than some large rapid response team which many people understandably have called for and are being talked about. The concept of having people sitting waiting for something happen and then responding I think is less well adapted to our world. That's one lesson to me.

A second one of course is the world is inter-connected, and we are vulnerable from the weakest links in the chain. These three countries … it's a part of the world that

many people don't really think about very much. I'm kind of interested in it, because in my first international assignment for CDC immediately after EIS, was actually five years in Côte d'Ivoire. So it's a part of the world that I'm interested in and actually like. We cannot ignore far away places and their issues because they'll come to you. I think that's a very major lesson.

And then just you know, the … I think there's obviously a lot of discussion about the local health architecture, which I won't go into, but there's the endless reports and discussions about who did what and who didn't do what they should have done, and obviously there's been a lot of discussion about WHO and its role and its structure. I think for the US, the focus from the administration and local health security and the funding that's been allocated to that now to the global health security agenda, I think is very appropriate. Those discussions had started before Ebola, but Ebola certainly demonstrated how justified and insightful those initiatives were. And for CDC, I think this experience will effect how we influence … how we do business. We are setting up offices in these three countries and will have a longer-term presence and I think that for CDC is a necessary reaction as well. I think those are some of the main lessons.

MH: *Right. Excellent. Could I just clear up [? 55:50] we could go on obviously, but I think that that's plenty for my purposes for now. I just want to get clear the actual dating of your three tours of duty. So you were there in July, and then you mentioned you left …*

K D C: It's mid-July to mid-August, early November to just before Christmas, and then I was there early March to early April this year. And again a remarkable event in this last deployment was the case of highly probable sexual transmission – the last case of Ebola in Liberia, I'm not sure if you're familiar with that?

MH: *He talked a little bit about it, this was part of the St Paul's Bridge cluster or after that?*

K D C: It was after that. The St Paul's Bridge cluster was finished. The last patient had been discharged from the Ebola treatment unit and was Ebola negative and in fact I was asked to Sierra Leone for some discussions and a colleague, Athalia Christie, a good colleague and I went to Sierra Leone and we were there for two or three days, she got a phone call saying there was another case in Monrovia, just when we were out of the country. And we investigated it. How is this possible? What's happened? The logical explanation would be it's somebody who's imported it from Sierra Leone or from Guinea, or it's somebody who's been exposed to ill persons from those countries, or there's on-going transmission we don't know about, which obviously we'd expected. A lot of our efforts were devoted to answering the question 'how would we recognise resurgent or imported Ebola if it happened?' So anyway, here we had a case and she had no obvious risk factors, but she was the sex partner of a man who had survived Ebola in the previous September, and she'd had sexual intercourse a week before she got sick. Anyway, we again, to cut a … make a long story short, this man was excreting … he was PCR positive in his semen 199 days after his illness onset, which whereas the advice which was being given by WHO and CDC was for Ebola survivors to abstain from sex or practice only protected sex with a condom for three months after recovery. And here he was, 199 days or 6 months after his recovery, still apparently with virus in his semen and this

was the only link this very unfortunate woman had. And she died. It was a very sad case. And of course a very tragic case, but handled as well as we could and one of the [? 59:35] aspects about it was it lead immediately to altered public health guidance.

MH: *It just underlines … you've reminded me how difficult it is to know you've got to zero, if I can put it that way. Because defining when you've actually eliminated a disease in terms of transmission is quite difficult when you just don't know everything about the pathology of the virus or the way it might persist in bodily fluids. There's so much that's still not known about Ebola.*

K D C: That's true.

MH: *Well it's absolutely fascinating to talk to you. Thank you so much for covering all this. I'm sure that in years and decades to come people will be fascinated to access this, and who knows what will have happened by then, and what parallels people may see. That's really really interesting. Are you back in Kenya now? Is that where we're speaking?*

K D C: Yes I'm in Kenya.

END OF RECORDING