



**After Immunity: Understanding the Post-COVID-19 World<sup>1</sup>**

**Episode Seven: The Next Pandemic After Immunity**

**Interview with Dr. Charlotte Hammer**

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Dr. Hammer, thank you for joining us

**Dr. Charlotte Hammer [CH]:** Thank you for having me.

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**IT:** So I think a helpful place to kind of kick us off here is understanding where COVID-19, the COVID-19 pandemic kind of sits within the broader context of the history of pandemics. This obviously is not humanity's first pandemic, it's not our first rodeo. So how do we compare the COVID-19 pandemic from previous pandemics over history?

**CH:** Now, this one is actually really difficult to answer. So, in a way, every pandemic is different, and for full disclosure, I'm not an historian of pandemics. There are a couple of really great people working on these kinds of issues. Names like Svenn-Erik Mamelund at Oslo Metropolitan University come to mind, and they specialize in studying historic pandemics, including the lessons learned for today and for the future. But what I can say is that obviously, you could argue that modern society is interconnected in ways that are pretty much incomparable with historic epidemics and pandemics, like the 1918 to 1919 Influenza pandemic, which we commonly refer to as the Spanish Flu. However, what we've seen over the last year is that most of the advice, if not the science behind the advice, is pretty similar to a hundred years ago. What worked then works now. Things like social distancing, like mask wearing, like bans on mass gatherings.

**IT:** Mm-hmm.

**CH:** And in general, really, the majority of our experience is with pandemic influenza, but obviously both being respiratory diseases, there is some overlap with COVID-19. And obviously, we had SARS mark one in 2003, but while that had a very severe impact on the countries affected, it was really at a different scale than what we're experiencing right now.

**IT:** Mm-hmm. So, I guess you could say the COVID-19 pandemic, as you said, the solutions are more-or-less kind of similar. You know, you have a respiratory disease, but it's kind of the scale that seems to compare it from at least the more recent pandemics. Would that be a fair characterization?

**CH:** I would definitely say so. We've seen a few flu pandemics over the last century, but none of them have these large-scale societal impacts that we're seeing now.

**IT:** Mm-hmm. And I want to get into that. I want to get into those societal impacts, and you specialize in kind of understanding the larger contextual factors of infectious disease risks. What were some of the factors that drove this pandemic? And obviously, the pandemic still happened, but how did we as a global society kind of do in terms of mitigating that risk?

**CH:** Absolutely. So, actually, a lot of those factors are quite similar across epidemics and pandemics, and it's actually that this emerging infectious disease just happens to be focusing the attention of people in high-income countries. Therefore, we might actually, in the future be in a position to tackle the challenge of emerging infectious diseases better than we have in the past, because in the past, in many cases, large scale outbreaks say, for example, the 2014 to 2016 Ebola outbreak in West Africa have happened in low and middle-income countries, and a lot of times the attention from high-income countries has been mostly in keeping the diseases over there rather than having them come to us. And maybe this now is the wake-up call that we need in terms of infectious diseases being a threat to everyone everywhere and being a challenge that we can only tackle and hopefully eventually overcome altogether. However, when we look at the current management, especially in terms of vaccine availability, there is a rather bleak picture

where vaccine nationalism seems to be the strategy of the day rather than global solidarity.

**IT:** Mm-hmm.

**CH:** But really, nobody is safe until everybody is safe, and that is a lesson that we clearly still have to learn.

**IT:** I'm glad you kind of brought up that vaccine nationalism, because I think that's something that's hitting home here, at least in Canada, in terms of our own lack of being able to manufacture the vaccine, you know, in Canada, and being kind of dependent on other countries, but those countries are now kind of saying, "Wait a minute, we need to kind of take care of our own." And I think the aspect, especially in developing countries, is precisely that. Developed countries are focusing on themselves and not really thinking about the developing countries. So just kind of circling back a little bit in terms of kind of the factors of this pandemic. Obviously, that's kind of where we're placed right now, but in terms of, obviously right now this idea of the pandemic, it's still, we're still kind of looking at how it kind of got started, right? But do we know what any of the factors that drove this pandemic to lead it to this large outbreak that we now are so acutely aware of?

**CH:** Yes and no. So most novel infectious diseases originate from animals. One of the papers that is really commonly cited in this context from 2008 is led by Kate Jones at UCL, and it's suggested that about 60 to 70 percent of infectious diseases have zoonotic origins. Infectious diseases in humans have zoonotic origins. So, it is pretty much given that this pandemic and also very likely that the next pandemic will originate from a so-called zoonotic spillover event.

However, on the flip side of that, not all spillover events lead to epidemics, let alone lead to pandemics. Now, colleagues at the University of Cambridge have shown a couple of years ago that, for example, for Ebola, the majority of spillovers leads to less than five cases. Most of them lead to no additional cases whatsoever. So, it's clearly not only that zoonotic spillover alone that is driving large epidemics and pandemics like the current one. It's really the depending on the context where the spillover happened and the level of what we call amplification after that. So how much additional transmission from human to human is then happening. And that can vary vastly from none at all to a great deal leading to a pandemic. Now, for the current pandemic, we do not yet know what those contextual factors are that have led from the spillover to the outbreak to the pandemic. The WHO task force investigating the origins of SARS-COVID-2 has really only just started its work, and only once we start to investigate and understand these first transmission chains will we eventually, hopefully, be able to pin down what has been the first domino for this pandemic. But this is really extremely complex work that will probably take years and it might never lead to a definitive answer. In fact, we've spent decades on this with Ebola and we've spent years on it with SARS-1 and with MERS.

But some factors are very likely culprits. So, if we in general look at spillover-born outbreak risk, there are three main mechanisms and reasons why a spillover happens. The first is a change in the pathogen itself, so say a mutation that makes the jump to humans or to domesticated species or to an intermediary host possible or more likely. Second is changes in the environment, with the environment becoming drier or the environment becoming wetter or being colonized by humans. And finally, which is kind of my specialty, the changes in the human-animal interactions such as land-use change or

humans encroaching on animal territories, animals encroaching on human territories, and really it is often a combination of those factors that you see.

**IT:** Mm-hmm. That's really interesting. That was exactly what I really wanted to hear in terms of just, you know, what are those kind of on the ground changes that are happening. So, I was wondering if you might be able to expand a little bit on that in terms of the land use. And so, in something like a growing pandemic, and I think of just situations where you're seeing countries really develop, continue to build large highways, things along this nature, and encroaching on the land that was previously only inhabited by kind of animals. As we see more of that encroachment, do we anticipate we're going to see more pandemics?

**CH:** Well, we'll definitely see more spillover. And then obviously it's a question of amplification, whether we will see more epidemics and pandemics from that. But often times this type of development comes exactly with the risk factors for amplification such as housing and population density, such as massive amounts of people moving from one area to another, and also things like people with different previous immunity moving into a new area. So, we have those risks for spillover converging with risks for amplification, and that can in these specific settings, make the perfect storm for the next pandemic.

**IT:** Mm-hmm. And I want to talk a little bit about that next pandemic, because some people might think that, you know, this might be the last pandemic. I don't know who, but I was wondering if you could kind of explain to the listeners a little bit about why the question is not "if", but "when" the next pandemic will be. Why is it a matter of just when?

**CH:** So first of all, from a logical point of view, pandemics have always been a feature of human life on Earth. I don't really see any reason why we would have now a massive shift that discontinues that trajectory, especially with those factors actually amplifying the likelihood of pandemics. There are some possibilities to significantly reduce the risks of pandemics originating from zoonotic spillover, which is the most likely source of the next pandemic. But that would require quite a substantial rethink in global health security and also a shift in our societal priorities globally. So novel diseases emerge all the time, so pandemics will happen as well. We've only seen a tiny fraction of the diseases that are expected to be found in wildlife, particularly in tropical rainforests. And tropical rainforests are the areas where this encroachment of humans is more and more happening, where we've seen massive amounts of development at the same time as we're seeing massive amounts of population growth. So really, as long as we exploit nature the way we do it right now, we will continue to encounter novel diseases, and that includes the types of animal husbandry and hunting that we're doing. And not only in this context, vilified wet markets that we've been hearing about a lot of in March and April last year, but also things like mass animal husbandry that we're seeing in many high-income countries.

**IT:** Mm-hmm. No, no. I think that's a really helpful way of kind of looking at this is, again, you know, it's the next pandemic will happen. And as you said, we're kind of seeing a little bit more of the contextual factors now being exacerbated to lead to another pandemic. I'd be remiss if I didn't ask, in your expertise on what time frame could we anticipate the next pandemic? Or is that too difficult kind of a question to say at this stage?

**CH:** Now, it's probably so uncertain that it is very difficult to say. I would be quite comfortable saying that I will probably in my lifetime see another pandemic, but beyond

that, it is not very easy to predict, and I'm not quite the right person to properly predict this as well.

**IT:** But that time frame of saying that, for some generations, they will see another pandemic in their lifetime. So, I think that's a useful place just to kind of... obviously it's not saying, you know, in two to three years or something, but nor would I anticipate that's quite possible.

**CH:** I mean, we don't know if it will be at this scale, but if I look back sort of within the timeframe of me being interested in infectious diseases, so say, go back to high school age, I have already seen multiple pandemics in that time. Obviously, what we see now is on a different scale entirely, but we've had H1N1 pandemic influenza, we've had SARS-1. So, we've already seen two relatively significant pandemics in the early 2000s.

**IT:** Mm-hmm. So, I want to kind of circle back and talk a little bit about risk mitigation, and we've talked a little bit about the risks that drive a pandemic, potentially drove this pandemic, but I want to kind of talk a little bit, you know, about the proactive aspect of this and kind of the supports that might be needed in the future in that post-COVID-19 world. In your view, what needs to happen to mitigate or eliminate the risks or the scale, I guess, of the next pandemic? What should governments be investing in terms of those risk mitigation policies in the post-COVID-19 world?

**CH:** So first of all, we need to acknowledge that these types of events will happen again, and we need to keep acknowledging that beyond the current pandemic. That means we need sustained funding for organizations that respond to health threats, that do research on emerging infectious diseases. We do need some technical solutions such as increased

surveillance, but it is very easy to forget that the best mitigation strategies are things like universal health coverage, social equity, environmental protection. Very often in my field, we see this scientific fascination with finding the virus or the pathogen, then with tests and diagnostics and vaccines, but really the risky context are more what we need to be looking at in the long term. And that's not really new. I mean, we've seen the field of emerging infectious diseases is about 40 years old. It developed in the context of AIDS initially and the term emerging infectious diseases was actually coined by Steve Morse, I believe, at a National Institute of Health conference. And back then, it was really this wholesale approach of things having to be tackled economically, environmentally, politically. But it has been kind of taken over from a more exclusively microbiological slant in the last couple of decades, and that obviously changed the agenda towards more technical solutions, which are really only a stopgap measure. We do need these measures, especially on the global scale, especially in the shorter term, but we also need to consider what type of society we want to be in the future, we need to address these large-scale drivers of emerging infectious diseases, and actually, this applies to pandemic prevention as much as it does to, say, climate change and in fact, mitigating climate change also mitigates future pandemics as climate change does drastically reduce the amount of livable land for both humans and animals on our planet, and that invariably will lead to increased human-wildlife contacts. However, there's also a positive side to this, so I'm trying to not to be too doom and gloom here.

**IT:** I appreciate that.

**CH:** If we look at the more distant root causes, we actually will see that these are the same for many of these immense challenges we are facing in the 21st century, and the solutions also respond to multiple challenges.

**IT:** So from the sounds of it, it sounds, you know, rather than just looking at this as any sort of level of I want to say maybe technocratic exercise a little bit, you know, a purely scientific, you know, leave it to the experts sort of lens rather than understanding, as you said, where or where our society should be. And I think it's really interesting to kind of bring that environmental lens into this equation, you know, another global catastrophe we may be facing in our lifetime is climate change, as you said. I think that's a really helpful way of framing this issue and expanding the issue a little larger. You mentioned about, you know, some of these aspects of investigating of looking into more research and some of these institutes, you know, the WHL, the European Center for Disease Prevention and Control, particularly the former populist governments around the world, I think particularly that of the U.S. government, have kind of questioned the legitimacy of some of these organizations, you know, and what they kind of do. In your view, where does the role of these global institutions kind of sit or fit into these mitigation plans of what we might kind of tie together in that kind of post-COVID-19 world?

**CH:** I mean, obviously, those institutions sit more on the technocratic end of solutions, but those are the solutions for the short to medium-term future.

**IT:** OK.

**CH:** And if anything, this pandemic has really shown that we need to strengthen the institutions. Both the WHO and ECDC are dependent on buy-in of their member states. They are not national institutes that have a direct mandate. In a globally connected world we do need these global solutions, and that includes things like epidemic intelligence and response mechanisms, because the moment you have a large-scale problem that crosses

borders, no country alone is capable of responding to these mechanisms. Some countries have amazing technological abilities, but it still needs that coordination. And what is very easy to overlook, I think, especially at the moment, where everyone is kind of looking to WHO, where suddenly names like Mike Ryan or Maria Van Kerkhove have become household names, is that what we're looking at is only one of the many faces and functions of these organizations. What we see on TV or in the news is really just this public-facing science, communication, and health diplomacy side, but the apparatus that is behind that is much, much larger and does a lot more than is necessarily easily seen from what we see every day.

**IT:** I want to switch directions a little bit and talk about kind of the vaccine rollout. You had mentioned a little bit about that vaccine nationalism, and that's certainly the case right now. You know, we have these we have the kind of the vaccine rollout underway in a lot of countries; it's a lot slower than anticipated in the developed countries, and it's uneven in its distribution, particularly in developing countries. I think it was the WHO that called it a moral failure of how we're distributing the vaccine to developing countries. It might still be too early to predict this, but in your view, what lessons might we learn from COVID-19 and how we roll out just vaccinations in general for these countries?

**CH:** We have seen a lot of problems with the vaccine rollout, and we've seen them very publicly. Things that might not in normal situations be as public. However, it's, I think, really important that we keep in mind that we managed to develop not one, but several vaccines in less than a year, and now we obviously have a task that we've never at this scale seen before. We have to vaccinate the entire world, which is a huge logistic task. I mean, we have had mass vaccination campaigns and disease elimination campaigns in the past, but not against the backdrop of a pandemic where we need to vaccinate very quickly. And

we've also to a little bit allowed ourselves to become paralyzed by some seemingly insurmountable challenges. Let's take, for example, the Pfizer-BioNTech vaccine and the issue with ultracold storage. So that's ultracold storage means a freezer of minus 70 to minus 80 degrees Celsius. And that's the kind of freezer that is not necessarily found in your average GP's office or in a warehouse...

...but what is really important to remember here is that the Ebola vaccine also requires ultracold chain, and we were able to deliver very successful vaccination campaigns with this vaccine in some of the most unstable regions of the Democratic Republic of the Congo. Again, completely different scale, but it is far from impossible, with a lot less ability and a lot less resources than we have in high-income countries. But, the other thing is that we really at the moment cannot afford to play this blame game, which seems to be going on to a certain degree. Rather than trying to determine who did what wrong when in the process of ordering vaccines or setting up logistics, we need everyone to work together. And that includes issues in high-income countries where we've seen issues with, as we call it, getting vaccines into arms in the US, as well as ordering doses in the EU. But it's really that vaccine equity issue that has me more worried because, at the end of the day, the low and middle-income countries really are ending up on the receiving end of the repercussions of vaccine nationalism. And we have seen some good measures for that and mechanisms such as COVAX, which has, at least on paper, been a really good effort for global vaccine equity, but obviously, if we don't strive for that equity again and again, and obviously that is difficult because everyone wants to get vaccinated now and that is very understandable, we will all suffer. But I think, again, trying not to be too doom and gloom, at the same time, we've also seen in the last couple of weeks seen the rollout of another vaccine facility that was highly successful. I mean, we now have the first global deployment ready stockpile of Ebola vaccines led by WHO, UNICEF, Red Cross, and

Doctors Without Borders. Because coming back to that, because we really need to remember COVID isn't really the only biological problem around, even right now.

**IT:** You've provided some great context for how we should be thinking about this rollout, and you mentioned something at the beginning, in terms of just the speed in which vaccines and the number of vaccines have been developed and the kind of the scientific breakthrough of that. And I kind of just wanted to keep on this topic just a little bit more in terms of this aspect of rollout, this aspect of creating vaccines, and the efficiency in which it's been developed on that front and kind of keep it in the context of that next pandemic. So, what aspects or what sort of traits or factors might you see as part of that next pandemic that we're talking about. What sort of factors would be included in that discussion because of this COVID-19 pandemic?

**CH:** I think that this pandemic has really shown us in terms of scientific development, what is possible. I think a year ago I would not have said, "Oh yeah, we will have a vaccine by the end of 2020." That seemed rather ambitious. We've had not one, but multiple. So, in that regard, it's really shown us what is possible if we speed up processes and really important to maintain it here. We did not sacrifice safety. We sacrificed to a certain degree financial safety. And the moment that finances are not the driving force anymore, there's a lot of room for improvement and speed up of this discovery. I think that is one of the things to kind of keep in mind for the next big epidemic or pandemic. The other thing that will definitely stay with us is the development of these new vaccine technologies, mainly mRNA, but also the vector-born vaccines like the one by Oxford University and AstraZeneca. So those will be things that we will be able to draw on the next time. Because in a way, this is almost for the next time like a proof-of-concept situation here. Then we've seen how global coordination can work with COVAX and with the role that the

GAVI, the Global Alliance for Vaccine Innovation, has been able to play. So, there's a lot of things that we can learn from, and on the other side, if we take the vaccine nationalism, we can also learn from that as a negative example.

**IT:** Dr. Hammer, this has been a very insightful conversation in terms of where this next pandemic kind of sits. Do you have any concluding thoughts on that next pandemic and after immunization to COVID-19 and anything that you think the listeners should know about in terms of that next pandemic?

**CH:** I think it's really, absolutely important that we remain vigilant for the next epidemic and pandemics. Now, obviously, we always remember retrospectively, that's human nature. So, we're always more likely to prepare for a repeat of the past than for the actual future, but the next pandemic might not look like this one, so we need to make sure that our preparedness plans are flexible and adaptable, and one early key lesson for many high-income countries will have to be not to relax because we feel prepared. I mean, we've seen how it developed with the US and the UK. Those two countries ranked the highest on the Global Health Security Index, which was exactly about pandemic preparedness to a degree. And sort of as a final, more technical point, I think the emergence of the new variants in the UK and South Africa and now in Brazil hopefully has, to a certain degree, driven home the need for more sequencing and more genomic surveillance.

**IT:** Mm-hmm. Dr. Hammer, we really appreciate your time being able to talk to us about this next pandemic. Thank you so much.

**CH:** Thank you for having me.

