EPISODE 7: THE CONSEQUENCES OF PIECEMEAL RESPONSES

MARIA ANDRIELLA O'BRIEN
Hello and welcome to Columbia Public Health Now, a podcast devoted to exploring the local and global implications of public health challenges in our communities. This Spring, we are focusing the series on the novel coronavirus, otherwise known as COVID-19, and its impact on our world and our health. I am your host Maria Andriella O'Brien and I thank you for listening.

Here, in the New York tri-state area, we might just be witnessing the impossible. After so much sacrifice and pain, the data is indicating that we may have begun to flatten the curve of COVID-19. We are not out of the woods yet. But, for the first time, it feels like we can try to look beyond the next few weeks to consider longer-term how to shape and implement what's being called an exit strategy. It’s reported that governors on the East Coast are consulting each other for ideas on how to slowly reopen operations in their states. It's a tricky thing, this exiting strategy. How to shape it and monitor it so we don't squander those gains that have been so hard won. Because the threat of COVID-19 is still out there. If we're going to consider relaxing policies to allow kids to return school, adults to go to work, families to eat out it helps to talk to a modeler. Today's guest—Dr. Jeffrey Shaman—is a professor of Environmental Health Sciences at Columbia’s Mailman School of Public Health. Prior to COVID-19, his modeling of infectious disease outbreaks helped us to understand the seasonal spread of the flu. Now, his team is devoting their energies to modeling COVID-19. Their projections have been shared with New York City, New York State and the White House. The models shed light on the different scenarios that lay before us—and how those scenarios change depending on our policies and behaviors. All important information to consider as we begin mapping out an exit strategy. Perhaps we can start with what you're seeing in the models as a trajectory for the United States and more locally for New York City.

DR. JEFFREY SHAMAN
Well, right now in New York City—let’s start locally there—we've seen over the last week, maybe a little bit more, a slowing of the exponential growth. Today is April 7th, just to give you a timestamp on what that is. Within the system of what we are dealing with, there is an inherent delay between the time when somebody acquires infection and when they actually are confirmed as a case. The reason for this is that a person is infected by someone else, through some mode of transmission that we don’t quite understand—it could be droplet, it could be aerosol, it could be from a surface—but they acquire the virus and the first thing that’s going to happen is they're going to go through a latent period where they're not manifesting symptoms and they themselves are not contagious but the virus is replicating in their body. That latent period lasts three to five days. If that person is then going to become symptomatic, they then have a pre-symptomatic phase and that lasts about one to three days where they're shedding the virus—they are contagious—but they themselves aren’t aware of any illness at that point. After that, they then start to have symptoms, and those symptoms will grow in intensity and at some point, if they get strong enough, that person will be motivated to seek clinical care. That may be three or five days later, at which point they would then go to a hospital or a doctor and if appropriate, they would be tested and that test would be sent out and it would come back. Now,
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the time that it takes for that test to be returned now it’s up to 12 hours, but people aren’t being admitted until they’re much sicker, so it’s a longer window of symptom growth, but it used to be three days. Some parts of the country, in truth, it’s about a week. You add that all together, and what you’re getting is ten to sixteen days between when somebody acquires the infection and when they’re actually confirmed. Let’s just call that two weeks, to be rough. In New York City, we’re three weeks out from the schools being shut and we’re two weeks out from when schools were shut everywhere and more extreme measures were put in place and people really began staying in their homes. So, we would expect to see slowing materialize starting about a week ago, which is indeed what we saw: slowing of the exponential growth. But what we’re really looking for is a flattening of the curve, as many people have talked about. The idea there is that today’s caseload—new cases that are confirmed—should be no greater than what they were yesterday. You do that, you’re no longer see any growth, and ultimately you want to bring that back down again in order to manage patient loads and relieve the strain that is currently being imposed on our healthcare system. Now, whether that will happen based on what we’ve already done is an open question because of that lag. We’re only starting to get that information in and it’s over this week that we’d like to see a flattening and hopefully a downturn in the number of cases that are taking place. I should say that the problem with this, of course, is that this requires that we be very patient, with a situation where we would rather not have to do that. We have to wait and see how these non-pharmaceutical interventions—isolation, quarantine, social distancing, shelter-in-place, no mass gatherings, school closure—how these effects are actually laid out in terms of reducing the case burden that we see. The other thing that’s important to realize is that there’s typically a further delay in ICU bed demand and hospital bed demand. That lags even further confirmed cases typically and, in some places, it’s up to two weeks and mortality can be up to two weeks as well. It’s a little shorter here in New York City, and they’re getting almost on top of each other, and that is because the healthcare system is overwhelmed—people aren’t getting ICU beds, and when they’re getting them in some cases, they’re dying very quickly if they do die.

What I’m saying is that it will be another couple of weeks, even if we flatten the curve and start bringing it down, before we see the same happening in our ICU bed demand, because people go into an ICU bed and they stay there for a while. The average length of stay there is weeks—so there’s accumulative demand there as opposed to just diagnosing cases. In the broader country, we’re dealing with something that’s a little trickier to get a handle on fully. Out on the west coast, if you look at San Francisco and Seattle, there’s been evidence for about a week now that they have flattened their curve so to speak—there’s some blips in variability there but we have to keep an eye on it. But then you have other places, like New Orleans and Detroit and some other locations, where they are still seeing aggressive exponential growth and they’re actually lagging behind where New York is. They may not quite have the numbers we do, but they’re seeing a lot of growth there. For instance, in New Orleans, they’ve got a very high death rate compared to other places in the country and it may be because it got into assisted living facilities there; it may have to do with the overall health and prevalence of chronic conditions in the populations in which it has penetrated, or other factors that we don’t know that may have to
do with documentation rates. So, there’s a lot of variability that we’re going to see from place to place, and there’s a lot to keep an eye on. The other problem of course, is that because we haven’t had a consistent messaging or a national policy set forth by the federal administration, we have a very piecemeal set of responses throughout the country, where some governors have been very proactive and aggressive and others have done nothing, virtually. The consequence of this—and there’s a whole range there—is we’re going to see different outcomes, and we will have to see how those map onto those policy decisions and start to use that to try to inform what we want to do going forward.

MARIA ANDRIELLA O’BRIEN
Maybe we could take a step back to look at the factors that go into modelling for COVID-19, and we’ve learned more about it. How are those factors changing the way you code the model and what you’re seeing?

DR. JEFFREY SHAMAN
That’s a good question. So, when we started out we actually first built the system in China and what we wanted to do was we wanted to try figure out what fraction of infections were undocumented, as opposed to the documented cases, and how contagious those undocumented individuals were on a per person basis and were they thus responsible for the spread of the virus. We saw that it was spreading very, very quickly geographically and what that meant to us was that there had to be a lot of silent, stealth transmission taking place. So, we set up this model in China where we would separate those people who were documented, confirmed cases of COVID-19 and say that there’s another group that we want to estimate that are all the undocumented cases and they have a contagiousness that may not be the same per person as those people who are documented. We built a model that’s called the “Meta-Population Model” that represents the transmission within distinct locations. In China, this was 375 different cities and they were linked by actual commuting, movement data surrounding the Lunar New Year. We modelled this for the point two weeks up to the point where travel restrictions were imposed in China—this was on January 23rd. So, we wanted to look at the virus prior to travel restrictions and control measures, and more active contact tracing that took place because we wanted to see how the virus transmitted in its natural state, unimpeded in a developed society.

What we found was that only fourteen percent, about one in seven, of all infections in China, prior to their implementation of travel restrictions and control measures, were actually documented—meaning eighty-six percent weren’t. Of those eighty-six undocumented cases per person, they were about half as contagious as a documented, confirmed case. This suggests that as your symptoms worsen, you may be more contagious over the span of your illness. But the fact is that there’s so many more of those undocumented cases, or infections, that they’re responsible for the lion’s share of the transmission that took place. Then we can say, “Alright, well what happens within our model if we run it again but this time, we shut off the transmission from the undocumented cases? We say that only documented cases, not undocumented cases
and infections, can transmit the virus.” When we do that, we lose a lot of the infections overall: 80% reduction in total infections. All this points to this conclusion that it is the silent or stealth transmission, supported by undocumented infections that facilitate the rapid growth in China, the geographic spread within the country, and the geographic spread internationally. That’s consistent with what we see. This virus, unfortunately, has the combination of ingredients that make it very, very concerning. Firstly, it’s a novel respiratory virus to which the world has no immunity—so almost one hundred percent of the population is susceptible to infection. By being susceptible, we are akin to being the dry tinder for a wildfire. Secondly, a lot of the infections are undocumented—they’re asymptomatic or mild, the type of infection that you or I would just go about our business, maybe take some ibuprofen if we had mild symptoms, but we would still go about our day, we would still use public transportation, go to work, bring the virus out in the community, and we’re contagious—so we can spread it to other people unwittingly. Thirdly, this thing has a fat tail, where there are enough people who are suffering severe and critical complications associated with the infection that it is concerning. There is a high enough case fatality rate that it is very concerning. We put that all together, and we’re looking at a pandemic that’s really the worst pandemic we’ve looked at since 1918 and it’s requiring a response that we need to manifest as a community that we haven’t had to do on local soil here in the United States since World War II.

To get back to your question—what have we done to make the model better since then—we have this classification of documented versus undocumented infections. We applied to model to the United States, then, in a slightly different form using counties rather than cities, we did it for over three thousand counties in the United States. We could make an initial estimate of those parameters again, and we found that up to March 13th, one in eleven people in the United States was being documented. That’s lower than what we’ve found for China and it’s consistent with the fact that there wasn’t a lot of availability of testing. So, that made a lot of sense. However, what didn’t make sense in our model that we wanted to improve on, was that we only had a single estimate of the transmissibility for documented cases and a single transmissibility for undocumented infections. And that’s not realistic because this is a respiratory virus and it thrives off contact. You don’t have to overlap in space and time for contact to make place. In other words, a person who’s infectious can walk into a grocery store and fill the air and cover the surface with virus and then somebody can come in a half-hour later and acquire the infection from that person, and they’ve actually never overlapped in space and time. But because they went to the same place, within a reasonable time, they can have a transmission event. It’s typically that contact that really makes this happen. There’s a difference between the contact rates that you might experience in rural Texas, versus what you get in Manhattan. We have a much higher population density; people are using subways and buses all the time. On a typical day, I myself know I would run into hundreds if not thousands of people, between trips on the subway, going to work, my kids go to school, going shopping—all those things. I’m also contending with any viruses somebody left behind in the last two hours as well. My scope of contact is enormous, whereas somebody who lives in a car culture in rural Montana, for instance, is not running into the same number of people. We need to reflect that heterogeneity
within our model. We’ve begun to do so; we’re recognizing that we actually need that in place if we’re going to make sense of it and allow for differences within a very heterogenous country, where you have very different population densities and different rates of contact amongst people consequently.

MARIA ANDRIELLA O’BRIEN
In a country like the United States, which has so many different policymakers: state, federal, county, city. What has your experience been with policymakers and other leaders to these forecasts?

DR. JEFFREY SHAMAN
I think a lot of people do get it, there is some disconnect. We, ourselves, are working with people at the Department of Health and Mental Hygiene, we are working with people in the New York State government, we’re working with the State Department and the White House Taskforce. We have been supplying them our model projections—we post them, they retrieve them. I know that they’re being used; Ambassador Deborah Birx has talked about the Columbia model a couple of times in her press conference, and that’s our model. But there is some disconnect going on there you know, three days ago Mayor DeBlasio insisted that we only just found out that asymptomatic transmission is possible. That’s been known for over a month. Our results of undocumented cases was posted the day after Valentine’s Day. Other people have shown pre-symptomatic shedding as we do in our findings as well, and mild and asymptomatic shedding as well. So, there are some gaps in communication that are taking place here. We can also see that with the White House as well; you need some convincing of political leaders, and they’re not always honing in on the features that they need to pay attention to. They’re not necessarily directing their attentions where they need to, to best inform their decisions.

Now, in terms of the models, there are a lot of questions about what do you do with the models. What are model projections, in particular, for? They’re not aligned into the future, there’s so much uncertainty in the system. This is a very, very challenging problem to make these projections, and to make them sensible and useful in any context. They are not forecasts. I wouldn’t call them that, because “forecasts” sort of implies there’s some known accuracy to them, that they have this reliability in calibration that we can bank on and that’s not the case here because firstly, we have this enormous lag in the system that I talked about. Secondly, the situation is so fluid and variable and we don’t have information on that always to inform what’s going on. Thirdly, we do not know what’s going to happen in the future, and in this situation, we are doing a lot of things to try to change the future. And because we don’t know that—we don’t know in the last two weeks how effective policies have been because we have no information on that, we don’t know what trajectory we are on. So, what do the models provide? Well, they provide sort of guidelines, or guideposts, or guardrails, that provide you information about possibilities if you were to follow certain scenarios and behavior. If you were to get this much
reduction in contact, effectively as it were, between people through social distancing, isolation, quarantine, school closure, restriction of mass gatherings, if you could have that much of an effect on the rate at which the virus is transmissible, this is where you’d be going. It allows you to suss out where you are and to plan a long-term strategy as to how you’re going to try to control this virus. It also allows you to understand some of the properties that we don’t know but we have to consider—such as, is this virus in fact seasonal? One of the things we truly don’t know is whether this virus is seasonal, and so one might say, “Well, why are you even considering it then?” That’s because there are four endemic coronaviruses out there that circulate all the time, that we’ve all had, that give us common colds—very mild typically, but they’re seasonal. There is considerable curiosity as to whether that seasonality of coronavirus is motivated by some similar factor, be it humidity or maybe even temperature. But we don’t know. If this virus is similar in that sense, to other coronaviruses, it may behave very much like what we’ve seen with pandemic influenza, which also has been sensitive to that. In 2009 we had a Spring wave of it here in New York City and then around June, it started to dissipate, and that was as humidity conditions really rose and also schools closed at that point. Then, in the fall, it started to ramp up again, and it actually started to do it before schools went back in session, intriguingly enough, as humidity levels started to drop down and it got drier, we had a bigger second wave, that was the fall wave, which was the big wave of it. The three other pandemics that we’ve had of influenza, in 1918, 1957, 1968, have shown similar characteristics. 1918 had a complete summer gap, where everything broke away. So, the question here is: Will coronavirus be modulated like that? Will it be sufficient that it drops down that we have a break, that we don’t get transmission for a little while in the summer? Which might be a big boon for us to get out and about, reboot the economy a little bit for a while, and figure out how we’re actually going to manage this long-term while preparing for what would likely be a return in the Fall months.

MARIA ANDRIELLA O’BRIEN
I think that would be a big change for our mindset because it seems as though people are so focused on getting through the next few weeks. How do we get to an exit strategy to think longer-term about what happens in October?

DR. JEFFREY SHAMAN
We have to do that I don’t want to be very grim here, and it’s easy for me to do it because I think about this a lot and I do feel like we’re caught between a bit of a rock and a hard place. If it doesn’t have this seasonality, we are going to be contending with this for a while, you know, our objectives right now with the social distancing is to flatten the curve and bring it down and relieve the strain on our healthcare systems. But then we’re stuck in a position right there, where if we relax those measures, that social distancing, restriction of mass gatherings, isolation, quarantine, that we’re trying to do, people wearing face masks—the virus is going to rebound. There’s no reason it won’t, as long as there’s a sufficiently large pool of susceptibles in the population, which we believe there is. Which means we’re stuck doing what we’re doing, which means that we’re all basically housebound, unemployment rates have skyrocketed, kids
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are not in school, the economic, psychological, and emotional toll that will impose on society is enormous. We will burn through this two trillion-dollar stimulus package very, very quickly. And so the question is, what do you do then if this is what you have to hold in place, and how long can society really do that before we have unrest, a suite of other economic concerns, health concerns that creep up because of this—that’s the rock and the hard place we’re stuck between right now. I would love to say we’re going to have a therapeutic that’s going to come down the line and that’s going to do something wonderful and it’s going to cure everything, it’s going to eliminate the rates of mortality and ICU bed need, and even hospitalization need, because it’s that miraculous. We have not typically seen something like that come down the pike with any kind of rapidity like that. So, holding our breath for something like that, I think, is a little unrealistic.

MARIA ANDRIELLA O’BRIEN
What might be the parameters for thinking about an exiting strategy? I believe the U.K. and Italy are both considering letting people go back to work if they can show that they have the antibodies to the disease. What are your thoughts on these different scenarios, or what is even the point that we can start talking about an exit strategy, as something that wouldn’t cause more harm than good?

DR. JEFFREY SHAMAN
Oh, I think we have to have that conversation right now and we have been having it. I think we rightly perceive that what we’re doing is incredibly disruptive and may have long-term consequences if we do it for too long, on the economy, which would be truly devastating for health as well, if we were to spiral into a ten-year global depression, right? The alternate that you pose, which would be to use antibody testing, would be a more robust way of going about this. In other words, somebody has to show they have an active, nice, high titer of antibodies that are reactive, cross-reactive to the virus, and then they can be let go back out to work, out in the community, and start doing things. It’s almost like, you know, you get out of jail pass, or you know, your stamp on your ID that would say you have high enough antibodies that you can go back out. The reason for this, just to back-peddle for a second—is that those people by having those antibodies they’re not going to be part of the transmission cycle anymore. They’re not going to be capable of being infected, and suffering an infection, replicating the virus in their body, and spreading it to others the same way. They will pre-emptively clear it because of that antibody presence, that’s the idea. They sort of short-circuit the transmission cycle, they don’t participate in it, they don’t bring it back to their homes and pass it on to people who might then have never been exposed to the virus and have a severe reaction. The one wrinkle in this, is that for SARS-CoV-1, antibodies lasted a very short period of time. There was rapidly waning immunity, so on the scale of just a year, which means that even at six months, some people lost antibody titers that were detectable. This brings up the concern, that it’s not a very long-lived immune process. So, what that might mean, would be that we might need to actively test and
repeatedly subject people to antibody testing every four to six months to make sure that they still have those antibodies at levels sufficient to preemptively clear a second infection.

MARIA ANDRIELLA O’BRIEN
Are there any game-changers that you see—interventions that we haven’t implemented in the states, for instance in China, my understanding is that people who were sick but not severely ill were sent to what they call “shelter hospitals,” the idea being that they wouldn’t go back to their homes and infect the rest of their families. Maybe that’s related to the high caseloads that we’re seeing in poorer communities here in the states, where there’s such tight living situations, and in New York City. I’m seeing it in my own community, where people who are infected are told to shelter in place, or isolate, may in fact be sharing it with their wider families who also have to be sheltering in place along with the infected. Are there interventions like that that we should be considering that might have a substantial impact on what you would see as the modelling for this?

DR. JEFFREY SHAMAN
Well, I would say modelling aside, yes. If it can be done effectively, it is. You would want to triage your patients who are coming in, identify those who are severely ill, those who are mildly ill, and those that are coming in with other issues—heart attacks, all the other routine medical services that we need to consider and deliver. And you want to segregate those groups. People who you think symptomatically are clearly infected with COVID, you’re going to have to put on one side, those who are mild, you would preferentially put to another facility. And those who are routine services you’d like to see go to another facility. The repurposing of the Javits Center, I believe, was originally designed to focus on people who didn’t have COVID, and to keep them segregated, and that’s an example of an attempt to try to do it. Unfortunately, the reality is there’s leakage here because a lot of people are affected asymptomatically and they may be coming in because they had a car accident and they may have COVID and not even know it, and they can bring it into that other situation and you can have it spread there. Further, you can have people who are manifesting with other respiratory viruses, for which they’re having a severe reaction, and they don’t have COVID and you might wind up putting them in a COVID ward. It’s very hard to keep that tight, and it’s nice to hear that China did it. It was undoubtedly a sloppy process where they had it as well, because tests can’t be turned around rapidly enough to ensure that you’re not having people infecting one another.

MARIA ANDRIELLA O’BRIEN
Thank you very much for your time Dr. Shaman, I really appreciate it.

DR. JEFFREY SHAMAN
My pleasure, and I would encourage people to try to keep appraised of the news and try to be optimistic about this, so we can try to figure out a way out of this. It’s very grim what I have to talk about, and I do think there is this impression that we’re stuck between a rock and hard
place but we have to keep trying to push ahead and figure out solutions that will work for us, minimize the risk to health, and minimize the death rate and suffering.

**MARIA ANDRIELLA O'BRIEN**

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