

# Dr. Yaneer Bar-Yam on the COVID-19 pandemic and a strategy to eliminate the virus

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*Dr. Yaneer Bar-Yam is an American scientist born in Boston, Massachusetts who received his Bachelor of Science and PhD in physics from the Massachusetts Institute of Technology. He is the founding president of New England Complex Systems Institute. His research has focused on formalizing complex systems and attempting to relate these to everyday social issues.*

*He is an expert in the quantitative analysis of pandemics and was an advisor to policy makers on the West Africa Ebola virus epidemic. In February 2020, he founded EndCoronavirus.org, a global network of thousands of volunteers to guide and provide policy on fighting the COVID-19 pandemic.*

*On January 26, 2020, Bar-Yam co-authored a brief on a comprehensive response to the spread of the virus during those first weeks in which the global threat from the novel coronavirus was becoming clear. Bar-Yam and his co-authors wrote, "Standard individual-scale policy approaches such as isolation, contact tracing and monitoring are rapidly overwhelmed in the face of mass infection, and thus also cannot be relied upon to stop a pandemic. Multiscale population approaches including drastically pruning contact networks using collective boundaries and social behavior change, and community self-monitoring are essential. Together, these observations lead to the necessity of a precautionary approach to current and potential pandemic outbreaks that must include constraining mobility patterns in the early stages of an outbreak, especially when little is known about the true parameters of the pathogen. It will cost something to reduce mobility in the short term, but to fail to do so will eventually cost everything—if not from this event, then one in the future."*

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Benjamin Mateus: Thank you for taking time to speak with the *World Socialist Web Site*. Last time we spoke you mentioned you had done extensive work on pandemic modeling. Maybe you can briefly explain what you do by way of an introduction.

Yaneer Bar-Yam: Good afternoon. It is my pleasure. So, a little bit of background. I am a physicist and a complexity scientist. [Behind this science] is that calculus and statistics do not describe the real world because of interdependencies [that exist]. So, when something over here depends on something over there, the mathematical frameworks do not describe what is happening. You would think that you can get closer and closer, but it actually does not work. There is a boundary beyond which you cannot go with calculus and statistics.

What you must do is actually develop new math and the key sort of fundamental framework for that was developed in 1970 by Ken Wilson. It is called renormalization group. And it is a mathematical framework that shifts how we think about the world. And the main thing we can pull out of this for the purposes of this conversation is that it identifies what are the most important variables in the problem which is the present pandemic.

What it really means is that you have to know that there are three things

that are important: One is the  $R_0$  value [the basic reproduction number] of the transmission, which can be greater than one [infections growing] or less than one [cases declining]. Second is restrictions on travel. If you do not have travel, you cannot have a pandemic. And the third is the number of infected individuals and the fact that zero is different from any other number, which basically means that if you control the outbreak enough, then you do not have an outbreak, but it has to be enough because if you still have 10 or a hundred cases, it's not the same as zero, which runs the risk of perpetuating the transmission of the pathogen.

The key thing is that if we understand all three of those variables are interdependent, we can put together a strategy. You have to know how to put things together in the right combination. And the right combination is very straightforward once you understand it. So, let me say what does not work. What does not work is what we are doing now. As the cases go up, we increase restrictions and as the cases go down, we decrease restrictions, which basically guarantees that we are constantly in a situation where we see the greatest number of cases that we can tolerate.

The right strategy is what we call the green zone strategy, which means you suppress the outbreak. You identify areas that do not have cases. So, they are at zero. You protect them by limiting travel between regions. Remember, travel is one of the variables. If an infected person goes into a green zone, that zone is no longer "green." But if you have eliminated infections from a region then you can open areas to normal [with contact tracers and testing capacity in place]. Then you progressively open up more areas that go "green" and allow people to travel between them. And if you do this right, it does not take very long. Basically it takes four to six weeks, a little bit longer if you have a lot of cases, but if you start from small areas, you can do this incredibly fast. That is the essence of the green zone strategy, which enables in a practical way to achieve elimination of the virus.

BM: How was the green zone strategy devised? What is it and when was this conceived?

YB: The interesting thing is that in some sense, this is the ancient way of fighting outbreaks. Everything that I have said is based on biblical to medieval strategies. The basic idea of restricted transmission is something that we know is ancient. Part of the problem is that in the recent times people have disparaged the old ways saying they do not work anymore, and we will do something new.

But this mathematical discussion, which, again, is anchored in a math that basically tells you what to focus on, was something that I started when I wrote a paper 15 years ago on pandemic dynamics. It was basically a paper on mutations in pathogens and how the combination of global transportation and mutational dynamics works together because the point is that if you separate how pathogens evolve from the effect of travel, you get one answer, but if you combine them together, you got a different answer. And the answer is that as we add long range transportation, the world, even only with a small amount of long-range transportation, you make a transition from local outbreaks to global

extinction [pandemic]. And in fact, the “regime” [mathematical concept] that we are in now with pathogen, with variants and so on, is exactly the “regime” that was analyzed in the paper.

BM: The issue that you are raising is a curious one. Epidemiologists like Dr. Michael Osterholm have been warning that such a pandemic is inevitable. The Ebola epidemic in West Africa had raised significant concerns that the world was completely unprepared for such an event. Even as late as the summer of 2019, the US conducted an exercise called “Crimson Contagion” to test the federal government’s capacity to contain a respiratory pathogen brought to the US from China. They predicted that a hundred million people would be infected and over 500,000 would die, concluding that the country was woefully unready for such an event. And then came the COVID-19 pandemic in a matter of a few months. How does the modeling and mathematics contrast with the discussions being had by epidemiologists and scientists?

YB: Fifteen years ago, I started to try to raise the alarm about the fact: What the science and math showed was that we cannot expect a slightly worse and then a slightly worse situation as the pandemic spreads. It gets dramatically worse all of a sudden. And people do not know how to react to such a catastrophe.

Yes, there were others that were sounding the alarm, but clearly no one paid sufficient attention. When Ebola happened in West Africa, I was involved at a policy level. And that was when we were very explicit about the strategies needed to stop outbreaks, and again, one of these narratives that is accepted in standard literature is that travel restrictions do not work because once the disease gets somewhere, then it is already out, and so on.

But that is incorrect. If we combine travel restrictions with lockdowns, then you are working to get rid of the disease more efficiently and effectively. The point is that it is using things together that enables you to overcome the problem.

And this is where the confusion arises because we think about things independently. Let me use an illustration. Let us say you thought about driving a car. You use the combination of the steering wheel, gas and brakes to bring the car to a stop safely. Using only one or the other will create accidents. You will not get far. That is what this is really about. There is this structural understanding that we were missing. The math helps explain what parameters of the pandemic we can control.

There is also this deeply engrained denialist attitude that says, “it’s never going to happen here. We are all set. We can deal with anything just because we think we are great,” and not realizing that there can be challenges that are life-threatening and society-threatening and can undermine our way of life and our, even our very existence. This idea that for 50 years or a hundred years, we have not had to face something that is devastating does not mean that we will not face it now.

This is the worst thing that has happened in say a hundred years in terms of the pandemic. And people did not think that it was going to happen. But it has happened. And now we are going into the fatalistic mode that we are stuck with it and this is the way it is going to be forever, which is also not a good mode. We have to understand what we have always had control over this pandemic.

BM: Last time we spoke you mentioned that we are looking at the pandemic from the perspective of individual cases—from a single person to another person. But you said, if I remember it correctly, that a community disease is not an individual disease. Can you maybe expand on that?

YB: The training that physicians go through is an individual-oriented training, right? There is a patient that comes in, they have a problem. You are going to figure out the problem. You are going to treat them. And that is the framework of thinking. And it is a very important framework, and it works really well if someone has a heart attack or other problems that are really individual problems, but a transmissible disease is by definition, something that is going from person to person.

Even though the individual symptoms or their conditions should be

treated as an individual, it is much better to prevent individuals from becoming infected in the first place. And that infected person is by definition, not an individual property, but rather it is a property of how people interact with each other.

We have to think about the set of people that are interacting together and the basic understanding that we need to start with is that it is a community property. It has to do with how people choose to interact with each other. It is in households. It happens in homes. But in the end of the day, the village is what we need to show up in the hospital or in a doctor’s office.

And one of the biggest concerns that I have had has been the fact that people are being sent home to their families to isolate or to quarantine. We know that leads to a lot of infections, serial infections within families. It has been widely reported. In order to stop that, people have to protect their families. They need a place to go where they are safe and where they can be taken care of, receive treatment [while] they are sick, brought food and also support [given to] their families so they do not worry about having to support their families or whatever, all of the concerns that someone will have, and end up being new vectors for the transmission of the virus.

Now, at the community level, the community, like an individual, has to take care of itself too when they are sick; a community has to take care of itself when there is a pandemic. And in West Africa, the way [Ebola] was stopped, and, again, they were expecting, the predictions were, millions of people dead, and it was stopped with 11,310 deaths. And the way it was stopped was by people going door to door, members of the neighborhood in Liberia, went door to door, did early identification of cases and isolated and quarantined people so that they would not transmit. And that was enough to stop Ebola. We know that works.

In India, during the current pandemic, in one of the worst slums in Asia, in Dharavi, people went door to door, over and over again, a couple of times a day. They did not even have enough testing, but they use oximeters and thermometers in order to identify cases. That was sufficient. They had isolation facilities and they had to do this in high density, urban contexts. You have to do case identification, super intensively, in order to stop the outbreak. But that is what works.

Now, in a suburb in the US, maybe you can do a lot of that by remote, calling people up and saying, how are you doing? Do you need help? Do you have symptoms? But the basic idea is the same, that you have to identify cases quickly. You have to isolate people away from family and housemates. Because otherwise the disease transmits; it is in the community. You have to do it. The way to think about this is that you think about the community as being sick and once the community is not sick, if there is no disease there, then you can open it up.

But, instead, we are caught in this loop of imposing restrictions to limit the disease spread, but we do not do enough to stop it. We open up again and then the cases go back up and then we are back into imposing restrictions.

BM: I wanted to ask about your thoughts on when the epidemic first broke out in Wuhan, China, and we recognized that person-to-person transmission was occurring, and the World Health Organization (WHO) began to understand the scope of the problem. What do you think went right? What do you think went wrong?

YB: What went right is that they said that this was a problem. This was dangerous. The main thing is that they said that action had to be rapidly taken. The main fundamental problem, however, was that [the WHO] did not explicitly say two things at the beginning: One, they did not say that the goal should be elimination and, two, they did not say the travel restrictions were essential. And those two go together. And this was the big failure.

There is no reason that just because the disease exists in the world, it has to be everywhere. But in order to prevent it from being everywhere, we have to take the measures that are necessary in order to prevent it. If you look at the US, if you look at other countries like Russia or across Europe

or across South America, many countries not only did not stop it from getting to the country, they allowed it to get everywhere in the country because they did not use travel restrictions to confine it. If you can confine it, the more you can confine it, the easier it is to get rid of it. But if you accept that it is going to be there, if you accept that it is going to become endemic, then you do not do travel restrictions nor elimination.

But once you know that you can get cases to go down—and we definitely found out that we could get cases to go down—then one should do the elimination strategy because the faster you do it, the less harm it does. And the less harm it does to everything, including illness, death, disability, all of these things—but also, the less economic harm.

People also do not understand that time is super important in pandemics. Everyone thinks that once you have something then it lasts forever. But if you can stop it, then the most important thing that costs you is the amount of time that it takes to get rid of. So, the more you limit it, the more you confined it in space and in time, the less is its impact on society.

BM: Shifting gears, the Centers for Disease Control and Prevention is now implementing new guidelines that will reduce physical distancing in schools from six to three feet. There has been much discussion on the role of children in the pandemic and the reopening of schools. Can you speak to this?

YB: This business about children do not transmit or they do not get sick is just wrong. Children do transmit and can get very sick. The major reason why there was some confusion is that kids have less severe cases. Often, they are asymptomatic. But the consequences for children are still significant.

They get long COVID, there are long-term disability implications for children. And to allow that to happen to children is a very incorrect thing to do, obviously. And of course, children also, because they transmit, even though they are asymptomatic much of the time, they transmit back into the community, back to their families, back to their schools, and many teachers have suffered the consequences of being infected by their students.

The whole idea that this is not a significant illness for children is incorrect. But, in addition, we are now seeing the new variants and that is a whole topic of discussion, which can provide more severe cases. Indeed, the situation that we see is that people who have been previously infected can be infected by the new variant. At least some of them, definitely the Brazilian variants in particular, they can be more fatal. It can even decrease the effectiveness of the vaccines. We are not sure by how much, but a loss of the effectiveness of immunity seems to be significant. And if that variant has immunity-evading property, then there are many other variants out there that also are immunity-evading.

Basically, if you now allow vaccinated people to get together in schools, at events and gatherings, and all the while there are these vaccine-evading variants, they will start growing. But people are not paying attention to these issues.

As these immune-evading variants lead to other outbreaks people will then begin clamoring for another vaccine. But what people do not understand is that when you have lots of variants, then you have many different genetic types and fighting many different genetic types is very different from fighting one genetic type.

The vaccines are specific to a type and now we have multiple types. Are you going to have 10 vaccines? Are you going to have hundreds? How long will this vaccine-only strategy work? And if we continue to have waves and waves of different variants, what of the continued harms to society, to the economy? These are just going to multiply. And what we are seeing is that the United States and some other countries in the world are making choices that are likely not to have very positive outcomes.

BM: What are your thoughts on the current vaccine distribution? The US is hoarding the vaccines. The EU is going through its own turmoil with loss of confidence in the AstraZeneca vaccine, vaccine hesitancy,

and slow rollout. The WHO has been calling for equitable distribution, but many low-income countries have yet to see even one dose. In the context of zero-COVID and the elimination strategy, can you speak to the COVID-19 vaccines?

YB: First of all, the vaccine is clearly a powerful tool. Like any other tool, it has its strengths and its limitations. If we use it effectively, it can be incredibly helpful. But if we rely on it exclusively, then it becomes a dangerous strategy and it is likely to fail us.

People are hoping that it will be the magic bullet, but it does not usually work that way. The most effective way to use a vaccine is a very traditional approach called ring vaccination, which means you use it as part of contact tracing, vaccinating the people who are most likely to get infected. Now, of course, we want to vaccinate also those people that are most likely to be harmed by the disease. But first we have to stop the disease from transmitting—stop the disease, *period*. So, the ideal strategy is to target elimination of the virus.

Ring vaccination, again, is basically vaccinating people that are most likely to be infected so that they do not spread the disease further. And that includes essential workers, medical personnel or anyone very likely to get infected. And then beyond that, one could argue that the countries that have the worst outbreaks, are the places that we should be vaccinating first, because they are the ones who have the people most likely to be infected.

But the short story is what we need to do is to make a decision that we want to get rid of the virus. And right now, we are continually making the decision that we want to live with it. If we decide to live with a virus, we are going to end up living with it. It is a self-fulfilling prophecy. We have the ability to make a different choice.

The fundamental, the real question is will we make that choice? And the consequences are like night and day, right? The challenge that we are facing is that community decisions are very difficult in a world where people do not interact with their neighbors, do not discuss things on a social level. That is the biggest challenge that we are facing right now in much of the industrialized world, where we have weakened community and family ties. And we are not making decisions in a shared way.

We do not need to wait for governments. It is not a government action. It is a community action. But the main thing is that in order for that to happen, people have to talk to each other and to own the problem. One of the main things that I have done in my work on pandemics, whether it's in the Congo or in the US or in Europe, is I have let people know that it is a decision that they have to make.

BM: The last question goes to the point you just made about communities working together in the context of the geopolitical issues and the globalization of the economy. The fight against the virus is also a political issue. The herd immunity policy which prioritizes profits over life and livelihood makes such a proposal complex. The present fight by teachers and school reopening is a case in point. The entire political apparatus is pressuring teachers to open schools. How are communities to fight this?

YB: Let me affirm very clearly that one of the key drivers of the failed response is the lack of compassion from those who are in positions of power, economic and political, to the people of their own country. This is a very bad situation. And it has really driven the pandemic harm, but of course it also drives harm from poverty and from work conditions and from everything else that causes harm in the context of social function. The main way to combat it is the same way that we have to fight the virus, which is to have communities understand that they have to own this responsibility.

It is not something that we can await until someone else does it for us. It is an action by the community. There is a failure of the social compact. There is a failure of representation. People are not being represented, that the desires and interests of the public are not being represented.

The press is a major instrument of confusion by amplifying the conflict in the society. They undermine our ability to work with each other and their narrative is false. Most people care about each other. Most people want to do the right thing. Most people want to work towards a solution to severe problems. And the press is amplifying the fringe in order to benefit from that controversy in terms of attracting attention.

And so, the most important thing is for people to reach out to each other, to express, not just in word, but, in deed, that they care about each other. And to collaborate together on the challenges that we face in the world and how we have to do that is not the same as we dealt with it in the past. Technology helps. We can collaborate, but we cannot get together in a crowd. We have to learn how to use the ability to talk to each other in groups and teams to share our understanding, galvanize our shared efforts to overcome the challenges that we face in the world.

BM: Dr. Bar-Yam, I want to thank you again for sharing your thoughts and your time with us. It has been very instructive.

YB: It has been my pleasure.



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