Tracking the pandemic means finding the 'canaries in the coalmine'

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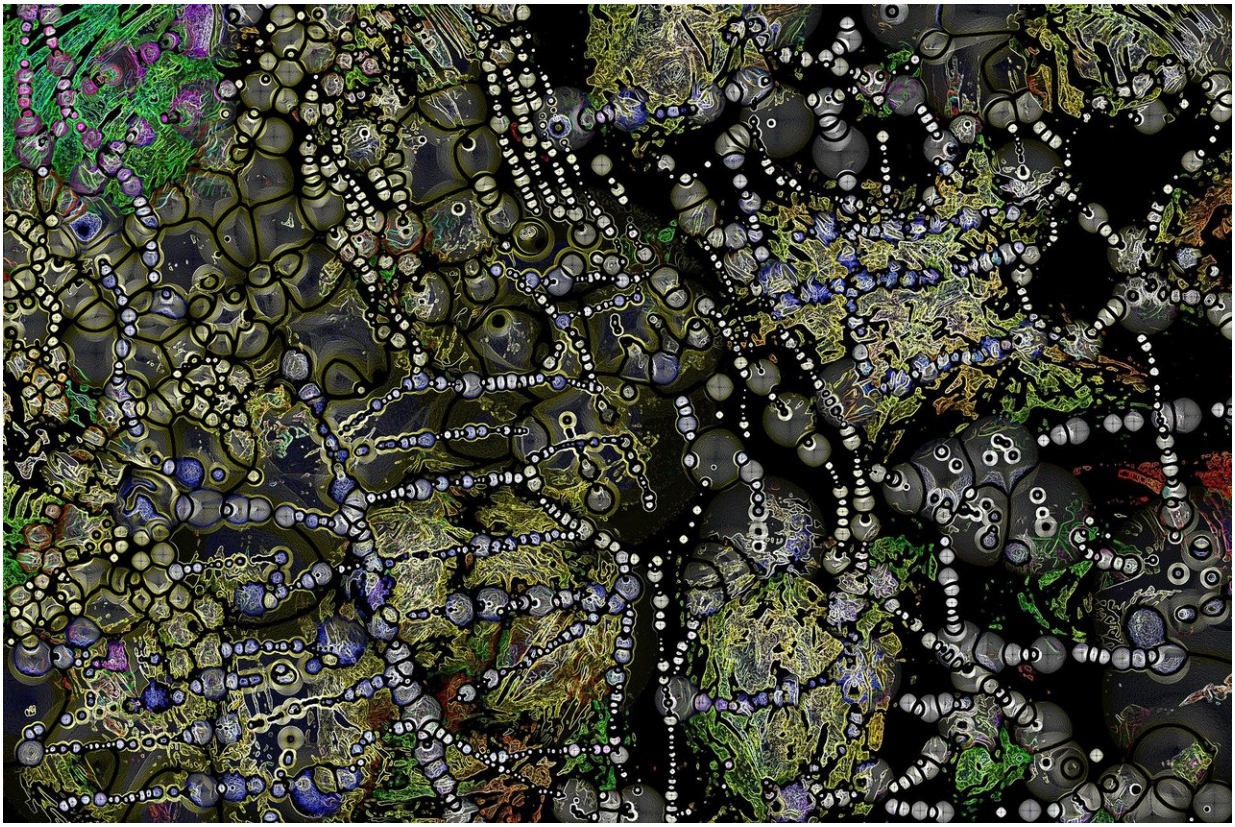

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Dr. Nicholas A. Christakis, Sterling Professor of Social and Natural Science at Yale, has devoted years to investigating how social networks affect our health and behavior. His work offers insight into how to track

and address epidemics like the current coronavirus crisis.

Christakis—a physician and social scientist who directs Yale's Human Nature Lab and co-directs the Yale Institute for Network Science—also studies human nature, a subject he examines in his latest bestselling book "Blueprint: The Evolutionary Origins of a Good Society" (Little, Brown Spark).

Christakis spoke with YaleNews about how, amid a pandemic, human nature can hurt us—and how it could help. Interview edited and condensed.

Why is it useful to consider the effect of social networks on epidemics?

The networks we study in the Human Nature Lab are face-to-face networks—they're composed of the interactions we have with our family, friends, coworkers, and neighbors. Of course, people also have interactions with strangers on the street and in shops. You might shake hands with a delivery person, that sort of thing. These are the kinds of connections one can understand through social network analysis. And these networks form the highways along which viruses spread, from person to person to person.

Understanding the structure of these networks, and the virus' behavior as it moves through them, gives us insight into how to interrupt the spread and defend ourselves. It also gives us opportunities to predict how the virus will spread.

How are social networks structured?

Imagine strings of Christmas tree lights. Every light represents a person

and the wires are the connections between people within the network. Imagine the strings are knotted at the center with tendrils emanating out to the periphery. That's sort of what a network looks like.

The people at the center of the network are the most likely to catch whatever is spreading, whether it's the latest gossip or a dangerous virus. They'll be the first to hear the gossip or catch the virus. The people on the edges of the network, those with few friends and contacts, are the least likely to hear the gossip or get sick. They might never catch the virus, but if they do, it'll happen late in the course of the epidemic.

How can we use this insight to predict the spread of a virus?

We have developed what we call "the network sensor method," which seeks to identify the individuals at the network's center, those with lot of friends and contacts, and passively monitor them. They could function as canaries in the coalmine because the virus will strike them before it reaches the wider population. This could provide an early warning system for epidemics and be useful in proactive planning for outbreaks.

Our research has proven that this method can work, during the H1N1 pandemic in 2009. My lab is now in the midst of updating these tools for the current environment, working with some Yale undergraduate and graduate students. We're developing a mobile app that uses the network sensor method to help people track flu cases in their cities.

What should individuals be doing to slow the virus' spread?

We need to avoid social mixing—both individually and collectively. Besides washing their hands, individuals need to keep a certain physical

distance from others (about four feet) and avoid touching each other. People should work from home if they can, and avoid non-essential meetings and travel. These are prudent steps anyone can take on their own. This kind of social distancing can help "flatten the curve," meaning it will lead to a more gradual rate of infection and thus prevent our healthcare systems from being overwhelmed.

How does human nature affect our ability to pull off social distancing?

It's in our nature to be social. It is very unnatural for us to avoid assembling in groups, to avoid seeing our friends, to stop shaking hands, or hugging each other. Doing all this doesn't feel normal to human beings. Yet, our natural social behavior is what the pathogen is exploiting.

There is a misconception among some people that the kind and brave thing to do is to shake people's hands and behave as if things were normal. They want to demonstrate that they're not afraid of the virus by interacting with others. In reality, the kind and altruistic thing to do is precisely the opposite of this. When you avoid unnecessary social contact right now, you are preventing the virus from using your body as a transmission vector. The virus is spreading and the more paths we can stop, the better off everyone will be.

Do people have innate tendencies that can help us fight the virus?

Absolutely. They include our natural tendency to cooperate, which the current situation certainly requires. Even as we're encouraged to distance ourselves from one another, we need to band together to fight this pandemic. We also have an innate capacity for teaching. We are very

unusual as animals in that we don't just learn from each other, we teach each other things. That affirmative ability to share knowledge is exactly the kind of thing we need right now.

What advice would you give to policymakers as they address the crisis?

Policymakers face challenging decisions about closing schools or cancelling large events. They also have to decide how to best allocate resources to support the public health. These aren't easy decisions because they involve a mix of demands that implicate public health, the economy, and our freedom to move about and gather as we please. Policymakers should be considering the thresholds for closing schools and banning large gatherings.

The most critical need as the epidemic crashes upon us will be the availability of hospital beds and ventilators for our ICUs. We need to do our best to plan for this.

Policymakers don't need to reinvent the wheel. There is accumulated knowledge on how to respond to pandemics. We don't know for sure how severe this pandemic will be, but it looks like it could be very significant, so we should act as though it will be very significant.

Are you addressing the coronavirus crisis in any new research?

I have a project with a Chinese team in which we're using big-data methods to develop what is, to my mind, an innovative idea that will allow us to forecast the pandemic in real time, in a useful way. That paper is under review right now.

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