[Are We Already Missing the Next Epidemic](#)?

Joshua M. Epstein*, *Politico*, March 31, 2020

If political leaders are to contend with the disease sweeping the world, they must understand that it only looks like one contagion. In reality, it is two.

One of them is the novel coronavirus itself, a new pathogen. The second contagion is ancient, more intractable, and more contagious: human fear.

It's not just a metaphor. Fear changes human behavior, for better and worse. As scientists and doctors fight the virus, the biggest challenge for government will become managing this second epidemic—the spread of fear and also its retreat, which can sometimes be even riskier.

I've built true-to-life computer models capturing how fear works in people and how it spreads through human societies. The best advice these models have to offer right now is that we need to think about the novel coronavirus as *four* separate epidemics: In addition to the disease it causes, Covid-19, there are also in epidemics of fear about the virus, fear about the economy—and likely soon—fear about a new vaccine. All four contagions are closely intertwined and will interact to amplify each other in complex ways.

To get the world back on track requires controlling all four horsemen of the Covid-19 apocalypse—which makes the response far more complicated than leaders seem to appreciate.

It will involve overlapping and ongoing responses: continued distancing and testing of people for infection; rapid fielding of a new antibody test to determine immunity so people can go back to work safely; development of a safe, effective vaccine to keep Covid-19 at bay; and—importantly—a persuasive information campaign, even before it arrives, against needless fears of vaccination. This combination offers the best chance of winning the long game against Covid-19.

Right now, and until we field a vaccine, there's no dispute that large-scale social distancing is the only tool we have to slow the immediate pandemic wave. However, it is important to recognize that distancing won't eradicate the disease—and that premature lifting of distancing can bring the disease back with a vengeance.

We have seen this before. In the falls and springs of 1918 and 1919, during a devastating influenza pandemic, virtually every major city in the U.S. and many European ones as well experienced two distinct waves of the "Spanish flu," separated by just over four months. The second wave of the disease has long been a mystery. It is very unlikely that the second wave was a new viral strain, produced by mutation. Instead, it's more likely that the wave was triggered by human behavior, and, in particular, by contagious fear.

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To demonstrate how this could explain the second-wave phenomenon, in 2008, several colleagues and I published a computer model of how disease spreads in a population, which we called the "coupled contagion" model. It included two contagions: one of disease itself, and one of *fear of* the disease. As infection spreads, so does fear of it. This fear can actually be helpful: When people are afraid, they take urgent action like self-isolation and quarantines, which suppress the spread of infection. However, once the level of infection gets low, the fear evaporates and people come out of the basement: social distancing is lifted, quarantines end, schools and theaters reopen, transportation resumes. In a case like this, it is the *decline* of fear that wreaks havoc. If even a few infected cases are still at large, the resumption of business as usual simply pours gasoline—in the form of susceptible people—on to those infectious embers, and a second wave ignites.

In 1918, exactly this behavioral story unfolded in Chicago. When the disease flared in October, Health Commissioner John Dill Robertson declared to the public, "If you have a cold and are coughing and sneezing ... go home and go to bed." Guidance like this suppressed the disease to very few cases by mid-November, at which point he wrote to the president of the Chicago Association of Commerce, "We are practically out of the woods. ... All bans are off." He was right. They were "practically" out of the woods. But for pandemics, "practically" isn't good enough. The premature lifting of social distancing led to second waves in Chicago and other major cities here and abroad.

Fatiguing and costly as it will be, we must not repeat this mistake out of zeal to reopen the economy. Instead, we need to use what we know—from biology, from experience, and also from new tools to model human behavior—to guide our response. Here's where they point us now:

First, social distancing needs to continue. We simply don't have enough information to let down our guard yet.

Second, rapid development and wide distribution of a blood test to detect antibodies to the virus is essential. Unlike the current test, which tracks the disease itself—and is crucial in allocating emergency resources and detecting where the outbreak is subsiding—the antibody test will tell us who's *had* the disease and may therefore be immune to reinfection. Anthony Fauci, the government's top infectious-disease official, has expressed high confidence in this "conferred immunity." As he put it, "It's never 100 percent, but I'd be willing to bet anything that people who recover are really protected against reinfection."

The huge economic importance of antibody testing is that able-bodied people in this immune group could *go back to work safely* and also provide backup to heath care workers to meet surge Covid-19 demand. To help policymakers think about how to reopen the economy, we've recently done a calculation on this. Erez Hatna, Abbey M. Jones at New York University's School of Global Public Health and I estimate that at least 36 percent of all Americans who contract Covid-19 will fall into this immune able-bodied labor pool.

Fauci has recently estimated that between 100,000 and 200,000 Americans will die in the course of the pandemic. If you assume (very conservatively) that 2 percent of infected people will die, then to end up with 100,000 deaths, you must have 5,000,000 infected people. If, as we estimate, 36 percent of those can work, you get an immune labor force of 1.8 million. At Fauci's higher figure of 200,000 deaths, you

get a workforce of 3.6 million. Either way, here is a labor force to help restart the economy without restarting the pandemic and bridge the gap until we have a vaccine.

Third, we'll need to get ahead of the potential vaccine fear. Much hope is being placed in a Covid-19 vaccine, now being rushed into development, but still a year to 18 months away at the earliest. Once it exists, the power of contagious fear to shape an epidemic's trajectory will likely show itself again. Given the steady growth of mistrust and misinformation surrounding vaccine safety in recent years, a Covid-19 vaccine—designed, tested and fielded under tremendous time pressures—is likely to be greeted with suspicion by many. And that is especially so if the young and healthy are seen as shouldering the risks of vaccination to protect more vulnerable populations.

Even a safe and effective vaccine will do no good if people refuse to take it. The World Health Organization recently included vaccine refusal in the top 10 threats to global health. Fear-driven vaccine refusal is responsible for the resurgence of measles in the U.S. and Europe and even polio in many countries. We cannot rule out the possibility that vaccine refusal will undermine the worldwide effort to bring this new coronavirus to heel.

Recent experience gives us reason for concern. In 2009, even after the WHO had declared swine flu to be a pandemic, 50 percent of Americans refused the vaccine. If fear and suspicion drove a similar proportion of Americans to decline an effective Covid-19 vaccine, then, given our estimates of its ability to spread, the coronavirus' transmission would likely stand right at the knife-edge between reignition and extinction. A third contagion, fear of the vaccine, could push us over the threshold into a renewed epidemic.

What do the models show? With Hatna at the NYU School of Global Public Health and Jennifer Crodelle of the Courant Institute of Mathematical Sciences at NYU, we have extended the coupled-contagion model discussed above, adding a third contagion, of vaccine fear. Everything turns on the relationship between the two fears, one of disease, the other of vaccine. In our model, if fear of disease exceeds fear of vaccine, then vaccine acceptance rises and the disease is suppressed. But if, at low disease prevalence, the fear of disease sinks below the fear of vaccine (as might happen when a disease recedes from our collective memory), people are more afraid of the vaccine than the disease. They eschew vaccine and a new disease cycle explodes.

This also rings true historically. Smallpox, one of the great scourges of human history, kills roughly 30 percent of those infected. Yet, even when inoculation (with cowpox) was discovered, cycles of vigilance and complacency kept smallpox alive. In her wonderful social history of smallpox, the *Speckled Monster,* Jennifer Carrell recounts, "In London, inoculation's popularity waxed and waned through the 1730s, with the force of the disease: in bad years, people flocked to be inoculated; in light years, the practice shrank. Inoculation was a security—the *only* security—to cling to within the terror of an epidemic; in times of good health, however, it looked like a foolish flirtation with danger."

We cannot afford such cycles of vigilance and complacency toward Covid-19, particularly if it is with us to stay, as a seasonal presence like flu, or if it continues to find sanctuary between human outbreaks in the kinds of wild animals from which it jumped in Wuhan.

One of the most challenging random variables in all this has been President Donald Trump, who has been a powerful agent of fear. To understand why, and how public

statements can do measurable damage, it helps to understand how our "fear model" reflects human behavior.

My own NYU lab specializes in "agent-based modeling" to figure out how real people respond to crises. Essentially, we build artificial societies of cognitively plausible software people who interact on computer-simulated landscapes to generate, or "grow," all sorts of social and economic dynamics, including epidemics. Unlike the cool-headed "rational actors" of standard economics, my latest software person, dubbed *Agent_Zero*, has emotions, and notably a *fear module,* a set of equations capturing both the acquisition of fear given a threat and its extinction in the threat's absence.

Recent advances in neuroscience provide the underpinning needed to endow our agents with such psychological depth. This field teaches us that the main driver of fear is *surprise*—the violation of expectations. In our *Agent_Zero* models, we have watched the power of surprise drive fear and generate contagions of collective behavior that range from counter-productive to disastrous.

Trump's initial stream of dismissive statements ("It's going to disappear. One day, it's like a miracle, it will disappear") did the same thing. They set us up for panic, including the financial panic he cares most about, by inflating expectations that were shattered by the truth.

After the baseless and false expectations Trump created, Americans responded with a surprise that rippled outward in predictable ways. Shock maximized the mutually amplifying fear spikes of disease and financial collapse, precisely when we should be controlling both.

Trump may never accept responsibility for the markets' panicked response to Covid-19. But our modeling suggests that he played a pivotal role in creating it.

We cannot afford another round of false expectations whose inevitable failure will generate new cascades of counter-productive fear and disease. We must accept the epidemiological evidence and tell the truth to our level best. We must learn from history and stay the social distancing course, develop the antibody test and use it to put people back to work *safely*. Most importantly, we must understand and manage our intertwined fears, especially the prospect that fear of vaccine may subvert our epidemic control efforts down the road.

We cannot repeat the mistakes of 1918. "Practically out of the woods" won't work. In a world that is globally connected physically and informationally—and hence emotionally—if anyone is still "in the woods," then we all are.