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How Much Herd Immunity Is Enough?

Scientists initially estimated that 60 to 70 percent of the population needed to acquire resistance to the coronavirus to banish it. Now Dr. Anthony Fauci and others are quietly shifting that number upward.

By Donald G. McNeil Jr.

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At what point does a country achieve herd immunity? What portion of the population must acquire resistance to the coronavirus, either through infection or vaccination, in order for the disease to fade away and life to return to normal?

Since the start of the pandemic, the figure that many epidemiologists have offered has been 60 to 70 percent. That range is still cited by the World Health Organization and is often repeated during discussions of the future course of the disease.

Although it is impossible to know with certainty what the limit will be until we reach it and transmission stops, having a good estimate is important: It gives Americans a sense of when we can hope to breathe freely again.

Recently, a figure to whom millions of Americans look for guidance — Dr. Anthony S. Fauci, an adviser to both the Trump administration and the incoming Biden administration — has begun incrementally raising his herd-immunity estimate.

In the pandemic's early days, Dr. Fauci tended to cite the same 60 to 70 percent estimate that most experts did. About a month ago, he began saying "70, 75 percent" in television interviews. And last week, in an interview with CNBC News, he said "75, 80, 85 percent" and "75 to 80-plus percent."

In a telephone interview the next day, Dr. Fauci acknowledged that he had slowly but deliberately been moving the goal posts. He is doing so, he said, partly based on new science, and partly on his gut feeling that the country is finally ready to hear what he really thinks.

Hard as it may be to hear, he said, he believes that it may take close to 90 percent immunity to bring the virus to a halt — almost as much as is needed to stop a measles outbreak.

Asked about Dr. Fauci's conclusions, prominent epidemiologists said that he might be proven right. The early range of 60 to 70 percent was almost undoubtedly too low, they said, and the virus is becoming more transmissible, so it will take greater herd immunity to stop it.

Dr. Fauci said that weeks ago, he had hesitated to publicly raise his estimate because many Americans seemed hesitant about vaccines, which they would need to accept almost universally in order for the country to achieve herd immunity.

Now that some polls are showing that many more Americans are ready, even eager, for vaccines, he said he felt he could deliver the tough message that the return to normal might take longer than anticipated.

"When polls said only about half of all Americans would take a vaccine, I was saying herd immunity would take 70 to 75 percent," Dr. Fauci said. "Then, when newer surveys said 60 percent or more would take it, I thought, 'I can nudge this up a bit,' so I went to 80, 85."

"We need to have some humility here," he added. "We really don't know what the real number is. I think the real range is somewhere between 70 to 90 percent. But, I'm not going to say 90 percent."

Doing so might be discouraging to Americans, he said, because he is not sure there will be enough voluntary acceptance of vaccines to reach that goal. Although sentiments about vaccines in polls have bounced up and down this year, several current ones suggest that about 20 percent of Americans say they are unwilling to accept any vaccine.

Also, Dr. Fauci noted, a herd-immunity figure at 90 percent or above is in the range of the infectiousness of measles.

"I'd bet my house that Covid isn't as contagious as measles," he said.

Measles is thought to be the world's most contagious disease; it can linger in the air for hours or drift through vents to infect people in other rooms. In some studies of outbreaks in crowded military barracks and student dormitories, it has kept transmitting until more than 95 percent of all residents are infected.

Interviews with epidemiologists regarding the degree of herd immunity needed to defeat the coronavirus produced a range of estimates, some of which were in line with Dr. Fauci's. They also came with a warning: All answers are merely "guesstimates."

"You tell me what numbers to put in my equations, and I'll give you the answer," said Marc Lipsitch, an epidemiologist at Harvard's T.H. Chan School of Public Health. "But you can't tell me the numbers, because nobody knows them."

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The only truly accurate measures of herd immunity are done in actual herds and come from studying animal viruses like rinderpest and foot-and-mouth disease, said Dr. David M. Morens, Dr. Fauci's senior adviser on epidemiology at the National Institute of Allergy and Infectious Diseases.

When cattle are penned in corrals, it is easy to measure how fast a disease spreads from one animal to another, he said. Humans move around, so studying disease spread among them is far harder.

The original assumption that it would take 60 to 70 percent immunity to stop the disease was based on early data from China and Italy, health experts noted.

Epidemiologists watching how fast cases doubled in those outbreaks calculated that the virus's reproduction number, or R0 — how many new victims each carrier infected — was about 3. So two out of three potential victims would have to become immune before each carrier infected fewer than one. When each carrier infects fewer than one new victim, the outbreak slowly dies out.

Two out of three is 66.7 percent, which established the range of 60 to 70 percent for herd immunity.

The French aircraft carrier Charles de Gaulle arriving in the port of Toulon in April, carrying infected sailors. Marine Nationale, via Agence France-Presse — Getty Images

Reinforcing that notion was a study conducted by the French military on the crew of the aircraft carrier Charles de Gaulle, which had an outbreak in late March, said Dr. Christopher J.L. Murray, director of the University of Washington's Institute for Health Metrics and Evaluation.

The study found that 1,064 of the 1,568 sailors aboard, or about 68 percent, had tested positive for the virus.

What You Need to Know About the Johnson & Johnson Vaccine Pause in the U.S.

- On April 13, 2021, U.S. health agencies called for an immediate pause in the use of Johnson & Johnson's single-dose Covid-19 vaccine after six recipients in the United States developed a rare disorder involving blood clots within one to three weeks of vaccination.
- All 50 states, Washington, D.C. and Puerto Rico temporarily halted or recommended providers pause the use of the vaccine. The U.S. military, federally run vaccination sites and a host of private companies, including CVS, Walgreens, Rite Aid, Walmart and Publix, also paused the injections.
- Fewer than one in a million Johnson & Johnson vaccinations are now under investigation. If there is indeed a risk of blood clots from the vaccine — which has yet to be determined — that risk is extremely low. The risk of getting Covid-19 in the

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But the carrier returned to port while the outbreak was still in progress, and the crew went into quarantine, so it was unclear whether the virus was finished infecting new sailors even after 68 percent had caught it.

Also, outbreaks aboard ships are poor models for those on land because infections move much faster in the close quarters of a vessel than in a free-roaming civilian population, said Dr. Natalie E. Dean, a biostatistician at the University of Florida.

More important, the early estimates from Wuhan and Italy were later revised upward, Dr. Lipsitch noted, once Chinese scientists realized they had undercounted the number of victims of the first wave. It took about two months to be certain that there were many asymptomatic people who had also spread the virus.

It also became clearer later that "superspreader events," in which one person infects dozens or even hundreds of others, played a large role in spreading Covid-19. Such events, in "normal" populations — in which no one wears masks and everyone attends events like parties, basketball tournaments or Broadway shows — can push the reproduction number upward to 4, 5 or even 6, experts said. Consequently, those scenarios call for higher herd immunity; for example, at an R0 of 5, more than four out of five people, or 80 percent, must be immune to slow down the virus.

Further complicating matters, there is a growing consensus among scientists that the virus itself is becoming more transmissible. A variant "Italian strain" with the mutation known as D614G has spread much faster than the original Wuhan variant. A newly identified mutation, sometimes called N501Y, that may make the virus even more infectious has recently appeared in Britain, South Africa and elsewhere.

The more transmissible a pathogen, the more people must become immune in order to stop it.

Dr. Morens and Dr. Lipsitch agreed with Dr. Fauci that the level of herd immunity needed to stop Covid-19 could be 85 percent or higher. "But that's a guesstimate," Dr. Lipsitch emphasized.

"Tony's reading the tea leaves," Dr. Morens said.

The Centers for Disease Control and Prevention offers no herd immunity estimate, saying on its website that "experts do not know."

Although W.H.O. scientists still sometimes cite the older 60 to 70 percent estimate, Dr. Katherine O'Brien, the agency's director of immunization, said that she now thought that range was too low. She declined to estimate what the correct higher one might be.

"We'd be leaning against very thin reeds if we tried to say what level of vaccine coverage would be needed to achieve it," she said. "We should say we just don't know. And it won't be a world or even national number. It will depend on what community you live in."

Dr. Dean noted that to stop transmission in a crowded city like New York, more people would have to achieve immunity than would be necessary in a less crowded place like Montana.

Even if Dr. Fauci is right and it will take 85 or even 90 percent herd immunity to completely stop coronavirus transmission, Dr. Lipsitch said, "we can still defang the virus sooner than that."

He added: "We don't have to have zero transmission in order to have a decent society. We have lots of diseases, like flu, transmitting all the time, and we don't shut down society for that. If we can vaccinate almost all the people who are most at risk of severe outcomes, then this would become a milder disease."

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