Herd immunity: When will we get there?

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Before the COVID-19 pandemic, the term "herd immunity" was possibly something you only heard about during flu season or during reports of upticks in measles cases—if at all.

But COVID-19 has brought that concept—when an infectious disease is less likely to spread because enough people have immunity either

through exposure or vaccination—to the front of our minds. Now that we have effective coronavirus vaccines, many are wondering if and when we will reach herd immunity with COVID-19.

While health experts are hopeful that day will come, there is much that remains unknown and much work—particularly with global vaccination efforts—that needs to be done to achieve the goal.

"The reality is that we don't know when herd immunity will occur. We haven't had this disease before. We can't say for sure what percentage of the population needs to be reached," says Manisha Juthani, MD, a Yale Medicine infectious diseases specialist. "There is not a certain number or cut-off; it's a gradient, meaning we'll know we've reached it if we see the number of cases, hospitalizations, and deaths go down. An overall improvement of our numbers will tell us we are reaching that threshold."

Below, Dr. Juthani and other Yale experts explain herd immunity, why it matters, and what needs to happen to get there.

Herd immunity: An explanation

Put simply, herd immunity means a large portion of a community is immune to a disease, making further disease spread unlikely. Immunity is conferred either by building antibodies after an infection from the virus or from a vaccine.

Ellen Foxman, MD, Ph.D., a Yale Medicine pathologist who is an expert in respiratory viruses, likens herd immunity to making the virus hit a "dead end."

"If you are coughing and sneezing, and the droplets reach someone who is susceptible, then the virus will keep spreading," Dr. Foxman says. "But if the virus reaches someone who has immunity, it is like hitting a wall.

The virus can't go any further."

The percentage of the population that needs to be immune to attain herd immunity varies by disease and how contagious that disease is. Measles, for example, spreads so easily that an estimated 95% of a population needs to be vaccinated to achieve herd immunity. In turn, the remaining 5% have protection because, at 95% coverage, measles will no longer spread. For polio, the threshold is about 80%.

It's important to note that herd immunity can be measured at the global, national, and community level and changes over time. So, if vaccination rates for a highly contagious disease go down in one pocket of the country, for example, the disease can resurface and spread in that area. "In 2019, there was a measles outbreak in Clark County, Washington, when the vaccination rate in public schools went down to 77 percent. That's what happens when the vaccination numbers dip," Dr. Foxman says.

Viruses like the flu, however, are different from measles in that they mutate over time, meaning antibodies from a previous infection won't provide protection for long. That's why the flu vaccine is reformulated each year to match what is expected to be the dominant strain in the coming season.

Likewise, the virus that causes COVID-19 has been mutating. While the authorized vaccines are effective against the current strains circulating in the U.S., researchers do not yet know how long immunity to COVID-19 lasts after infection or vaccination. So, a booster shot [an additional vaccine dose] of some kind may well be necessary, Dr. Juthani says.

There is no magic number

At the start of the pandemic, figures like 60 to 70% were given as

estimates of how much of the population would need immunity from the coronavirus in order to reach herd immunity.

With the increase in variants, which are more infectious and could potentially impact the effectiveness of the vaccines, that percentage is now estimated to be higher—some say up to 85%. And it has become more difficult to pin down.

But that's not necessarily cause for concern. "When you reach the herd immunity threshold in a population, it doesn't happen all of a sudden, like you've flipped a switch. There won't be a New York Times headline saying nobody has the disease," explains Saad Omer, MBBS, Ph.D., MPH, director of the Yale Institute for Global Health. "What happens is it reduces the indigenous, or endemic, transmission of the virus." The spread of disease gradually slows.

Therefore, even when the herd immunity threshold is attained, there will still be smaller outbreaks. "That's because vaccine coverage is always uneven. You can have these places where embers spark local fires," Dr. Omer says.

Another unknown variable in terms of herd immunity involves children, as there is still no approved vaccine for those under age 16. Clinical trials are in the works for children as young as six months old.

"Children certainly count in the denominator for herd immunity. Their risk of severe disease is lower than their grandparents, but it's still a reasonable risk," Dr. Omer says. "If we want to have schools open, where there are no outbreaks and the control is sustainable, we'll have to vaccinate kids. And these trials right now in children are being done systematically, and hopefully the authorization will be available soon."

The indirect effects of herd immunity

Among vaccine experts, the term "community immunity" is preferred over herd immunity, says Dr. Omer. "Population immunity" is another term commonly used.

But they all have the same meaning—and include the indirect benefit of protecting vulnerable groups. For example, some people have medical conditions—or are undergoing specific cancer treatments—that cause them to produce few or no antibodies in response to a vaccine. With herd immunity reducing spread of the virus in a vulnerable person's community, they are protected by default.

"We increase vaccine coverage and thereby decrease disease transmission," Dr. Omer says. "That way, people who are not vaccinated are also protected indirectly, because there's less virus to go around."

Dr. Juthani notes that the indirect benefits of mass vaccination are sometimes invisible to the general public.

But reframing the way you think about herd immunity might be helpful, she adds. "If you think of your extended family as your herd, it may better illustrate the concept of protection," she says. "Knowing that everyone getting vaccinated—and not harboring any virus—can protect, for example, a grandparent with cancer or a cousin who is immuno-compromised, can make the benefits of getting vaccinated feel less abstract and more tangible."

That mindset is important, adds Dr. Omer. "We will see an increase in the indirect, or community, effects of vaccines as the rates of vaccination go up."

Vaccination vs. variants

For Dr. Foxman, the take-home message when it comes to herd immunity is simple.

"Get vaccinated. It's the only way out of this pandemic," says Dr. Foxman. "When this virus emerged, no one on the entire planet had pre-existing immunity. Whether through vaccination or exposure, immunity basically puts the brakes on a virus. Immune defenses slow down how much a virus can spread in your body and how much it can spread from person to person."

It's likely, Dr. Foxman says, that instead of COVID-19 being eradicated, it becomes endemic, a term that describes when an infectious disease is constantly present in a population at a baseline, or predictable, level (much like the flu or common cold).

"The virus may still circulate, but it will not cause the same level of severe illness that it has in the past," she explains. "But the wild card with COVID is the emergence of new variants. These are variations of the virus that crop up and can spread better because of their biology or because they are evading the immune system. We need to get vaccinated as soon as we can so we can prevent the spread of COVID-19, which will also prevent the emergence of variants. It's a race between vaccination and variants."

While it's normal for viruses to mutate, this occurred more quickly with COVID-19 than health experts expected, Dr. Juthani says.

"More variants will emerge with time—we will see homegrown variants and imports from other parts of the world—and the concern is that, at some point, the vaccines may not be as effective against these variants," she says. "That's why many are talking about getting boosters to prevent that."

Think global, act local

Dr. Juthani says she believes herd immunity can be achieved, but that it may take several years.

"We need to get the rest of the world vaccinated, and that is happening more slowly than we would like," she says. "The current outbreak in India is also putting a wrench in global vaccination plans since many vaccines are mass produced in India."

While the vaccination pace in the U.S. has been swift, that is not the case worldwide. As of May 2, 43.9% of the U.S. population have had at least one vaccine dose and 30.9% are fully vaccinated. Worldwide, only 3.5% are fully vaccinated.

There are several reasons to be concerned about COVID in other countries, Dr. Omer says, even if we think it doesn't directly affect us.

"There is a responsibility that comes with the resources that each country has. We will be judged by our children and grandchildren in terms of how we behaved in this pandemic," he says, noting that "what is happening in India and in other places, is happening on our watch. We are privileged to live in a country where these vaccines are available. Everyone should go out and get it."

And, there is also the case of "enlightened self-interest," Dr. Omer adds.

"A widespread pandemic is dangerous for everyone. We know there is a threat of variants. For the variants in the U.S., lab evidence suggests that these vaccines will continue to work against them. But if we continue to let this pandemic run wild in places like India, there is a probability that there will eventually be a variant against which the vaccines will be less effective."

"Right now, the dam is holding," he says. "But why test the dam by tempting it with these large tidal waves coming through?"

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