COVID-19

How the coronavirus spreads so quickly and how you can slow it down

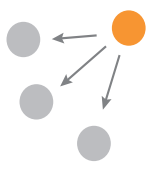
BY JANIE HASEMAN, VERONICA BRAVO, MITCHELL THORSON AND SHAWN SULLIVAN/USA TODAY

Not long after the novel coronavirus — which causes the disease COVID-19 — was first discovered in China, scientists and doctors warned that the virus could spread around the world. It has now spread to at least 115 countries, with thousands of people in the United States now reported to have COVID-19. But how is the virus spreading so quickly? It all comes down to the basic reproductive number, or how many new people contract the virus from one infected person. This is how it's calculated — and how we can reduce it.

How contagious is coronavirus?

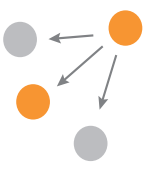
A key factor in studying the spread of disease is determining the average number of new people who will be infected by each person with the virus. This is called R_0, or the basic reproductive number. There are many, many variables that can go into calculating R_0, but at the most basic level it involves 3 numbers.

First, the number of people each infected person has contact with is estimated. In this hypothetical example, let's say each infected person comes into contact with 3 people susceptible to the virus.



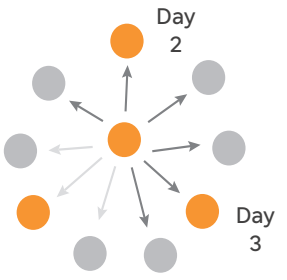
3 contacts per day

The number of contacts is then multiplied by the percent chance that 1 of those contacts has been infected. In this hypothetical, let's say the chance was 33%.



3 contacts per day X 1/3 chance of infection on contact

That number is then multiplied by the length of time individuals are able to contract the disease from the infected person.



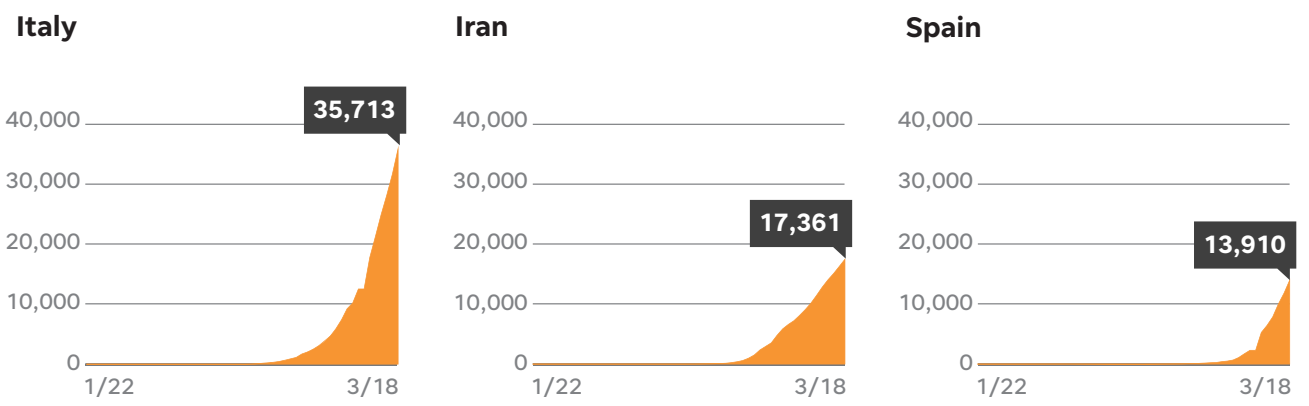
3 contacts per day X 1/3 chance of infection on contact X 3-day infectious period
= R_0 of 3

So if someone with this hypothetical virus had contact with 3 people per day, and there was a 1 in 3 chance of infection for each contact, and the infected person was contagious for three days, the R_0 would be 3. About 3 new people would contract the illness from each person infected.

Again, there are a lot of other variables that epidemiologists can add into this equation — those are only the basics.

The R_0 of coronavirus is usually estimated to be somewhere between 2 and 3. This means that if one person contracts the virus, the next wave of infection — assuming there was no intervention — would be 2 to 3 times as large. It's why the number of people affected increases rapidly after the first case in an area.

Researchers don't know exactly what the R_0 is for certain because no one has complete data on who has been infected.



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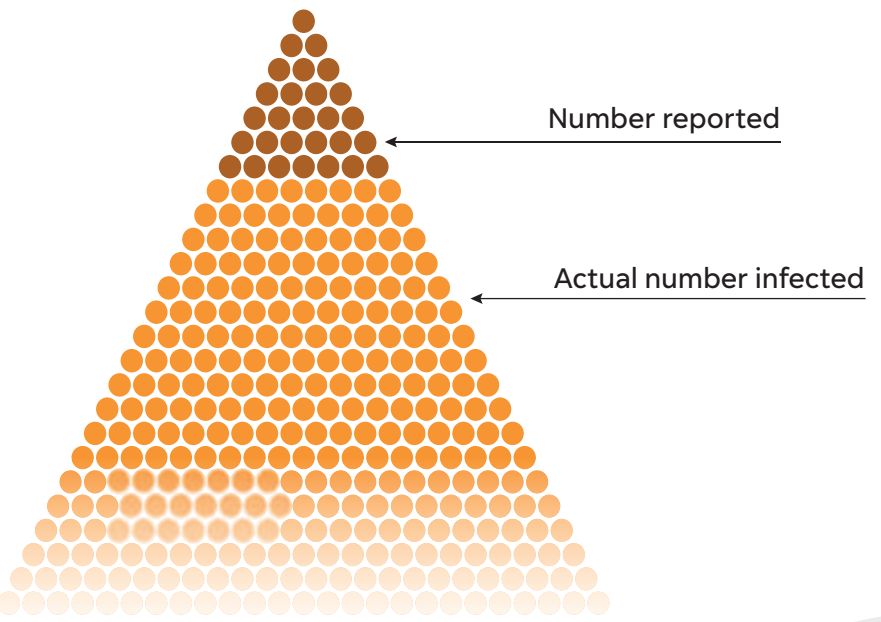
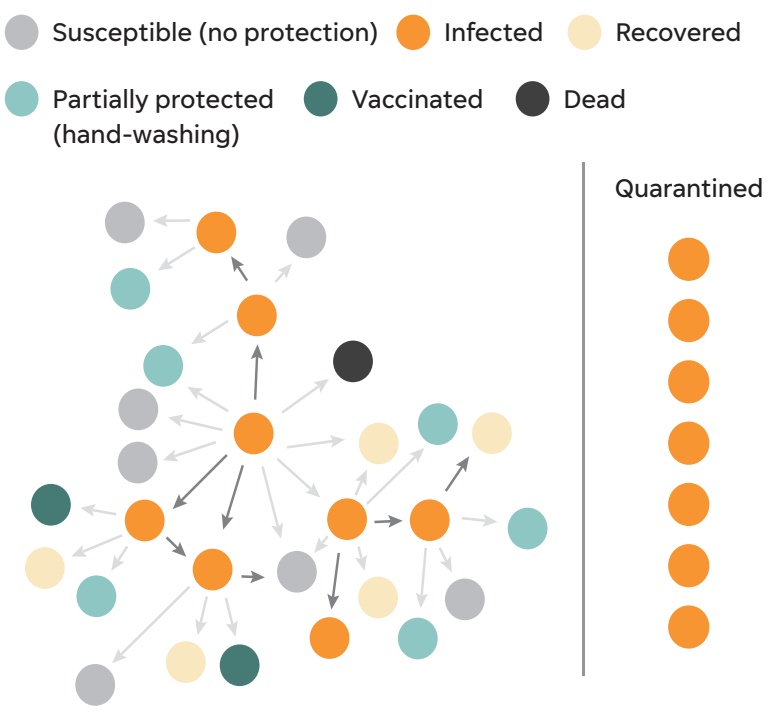
Most of the coronavirus charts and maps you've probably been seeing, including the charts above, show the number of reported COVID-19 cases. But many people who have COVID-19 — and no one knows how many — are not being counted by medical authorities. COVID-19 can have mild symptoms or even no symptoms at all, and some people are unaware they even have the disease.

This means that in order to calculate R_0 and other variables, researchers need to make assumptions about the number of people infected and other missing data. As a result, statistical estimates from different studies can vary. This is why while we know that the basic reproductive number of coronavirus is probably between 1 and 3, the exact number is still uncertain.

Because we don't know for sure how many people have the virus, an area with 10 reported cases could easily have 100 cases in reality. And because of the exponential growth of the number of people with the coronavirus, those 100 cases could become 1,000 within a week.





So how do we stop the disease?

For as long as more than 1 new person, on average, contracts the disease from each infected person, COVID-19 will continue to spread. When the effective reproductive number is below 1 — in other words, when each person with the virus is infecting less than 1 new person on average — the virus will fade away.

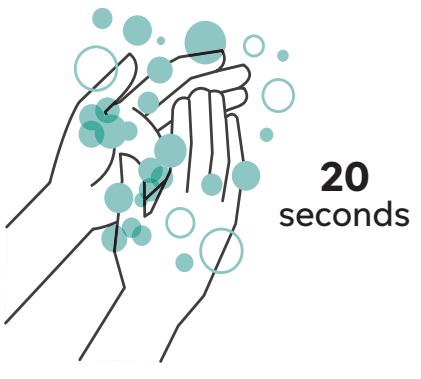
This likely won't happen for a while, but we can slow the spread of the virus by taking precautionary measures. By decreasing any part of the numbers that make up R_0 — number of contacts, risk of transmission, or duration — we can decrease the number of new people contracting the virus, thus slowing the spread of disease.

Taking measures to reduce the reproductive number is critical to reducing the havoc COVID-19 can wreak, and it's why we hear a lot about restricting travel, self-isolation, and hand-washing.

What the coronavirus pandemic will look like in the coming weeks and months is largely in our hands — we can all take steps to slow its spread and minimize its impact.

One of the most effective ways to prevent the spread of coronavirus is reducing the number of contacts you have, whether or not you feel ill. This is called "social distancing" — staying away from people with whom you don't require contact.

While it's not as helpful as staying put, we can also decrease the probability a given contact will get the disease using preventive measures like hand-washing.



Finally, treatments eventually may be able to reduce the duration of the disease by one day.

SOURCE Johns Hopkins University; WHO; CDC; USA TODAY research