World Health Organization

Vaccine efficacy, effectiveness and protection

14 July 2021

العربية   中文   **Français**   **Русский**   **Español**   **Português**

This article is part of a series of explainers on vaccine development and distribution. Learn more about vaccines – from how they work and how they're made to ensuring safety and equitable access – in WHO's Vaccines Explained series.

COVID-19 vaccines have proven to be safe, effective and life-saving. Like all vaccines, they do not fully protect everyone who is vaccinated, and we do not yet know how well they can prevent people from transmitting the virus to others. So as well as getting vaccinated, we must also continue with other measures to fight the pandemic.

Vaccine efficacy and effectiveness

All COVID-19 vaccines approved by WHO for emergency use listing have been through randomized clinical trials to test their quality, safety and efficacy. To be approved, vaccines are required to have a high efficacy rate of 50% or above. After approval, they continue to be monitored for ongoing safety and effectiveness. But what is the difference between efficacy and effectiveness?

A vaccine's **efficacy** is measured in a controlled clinical trial and is based on how many people who got vaccinated developed the 'outcome of interest' (usually disease) compared with how many people who got the placebo (dummy vaccine) developed the same outcome. Once the study is complete, the numbers of sick people in each group are compared, in order to calculate the relative risk of getting sick depending on whether or not the subjects received the vaccine. From this we get the efficacy – a measure of how much the vaccine lowered the risk of getting sick. If a vaccine has high efficacy, a lot fewer people in the group who received the vaccine got sick than the people in the group who received the placebo.

So, for example, let's imagine a vaccine with a proven efficacy of 80%. This means that – out of the people in the clinical trial – those who received the vaccine were at a 80% lower risk of developing disease than the group who received the placebo. This is calculated by comparing the number of cases of disease in the vaccinated group versus the placebo group. An efficacy of 80% does not mean that 20% of the vaccinated group will become ill.
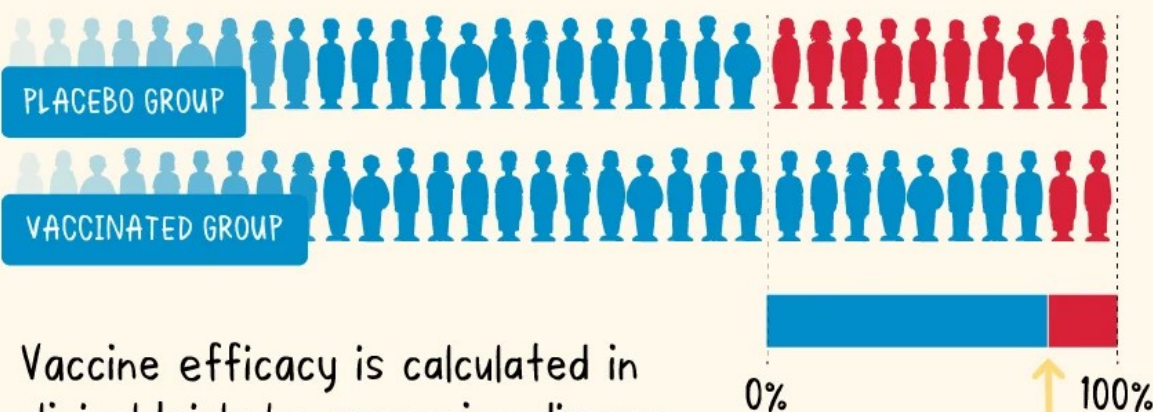
Vaccine efficacy
refers to how the vaccine performs in ideal conditions – controlled clinical trials.

Vaccine effectiveness
refers to how the vaccine performs in the wider populations.

PLACEBO GROUP

VACCINATED GROUP

Vaccine efficacy is calculated in clinical trials by comparing disease rates between two groups: those who received a placebo and those who received the vaccine.

0%   100%

80% REDUCTION = 80% EFFICACY

Vaccine **effectiveness** is a measure of how well vaccines work in the real world. Clinical trials include a wide range of people – a broad age range, both sexes, different ethnicities and those with known medical conditions – but they cannot be a perfect representation of the whole population. The efficacy seen in clinical trials applies to specific outcomes in a clinical trial . Effectiveness is measured by observing how well the vaccines work to protect communities as a whole. Effectiveness in the real world can differ from the efficacy measured in a trial, because we can't predict exactly how effective vaccination will be for a much bigger and more variable population getting vaccinated in more real life conditions.

Vaccine protection and timing

Vaccines offer strong protection, but that protection takes time to build. People must take all the required doses of a vaccine to build full immunity. For two-dose vaccines, vaccines only give partial protection after the first dose, and the second dose increases that protection. It takes time before protection reaches its maximum level a few weeks after the second dose. For a one-dose vaccine, people will have built maximum immunity against COVID-19 a few weeks after getting vaccinated.
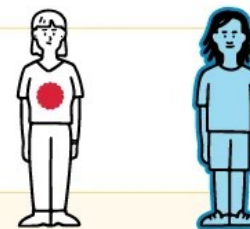
Vaccine protection and infection

Vaccines can stop most people from getting sick with COVID-19, but not everyone.

Even after someone takes all of the recommended doses and waits a few weeks for immunity to build up, there is still a chance that they can get infected. Vaccines do not provide full (100%) protection, so 'breakthrough infections' – where people get the virus, despite having been fully vaccinated – will occur.
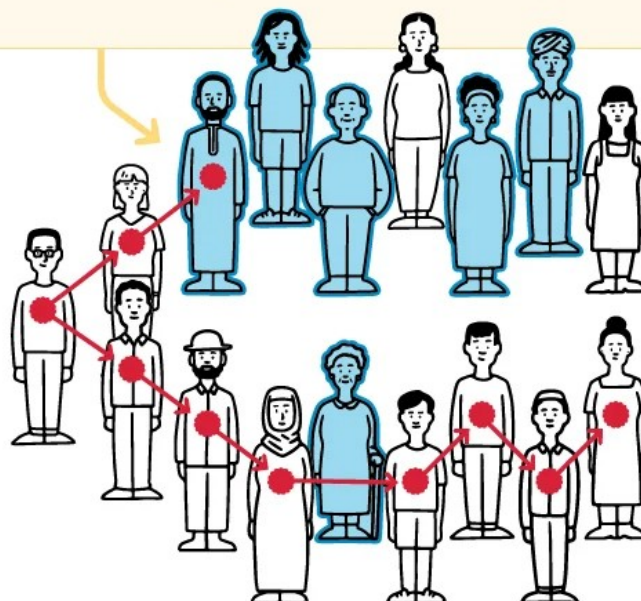
If vaccinated people do get sick, they are likely to have milder symptoms, in general 'It is very rare for someone vaccinated to experience severe illness or die.

Vaccine protection and transmission

COVID-19 vaccines are crucial tools in the pandemic response and protect against severe disease and death. Vaccines provide at least some protection from infection and transmission, but not as much as the protection they provide against serious illness and death. More evidence is needed to determine exactly how well they stop infection and transmission.

After being vaccinated, individuals should continue taking simple precautions, such as physical distancing, wearing a mask, keeping rooms well ventilated, avoiding crowds, cleaning hands, and coughing into a bent elbow or tissue. Get tested if you are sick, even if you've been vaccinated. Check local advice where you live and work. Do it all!
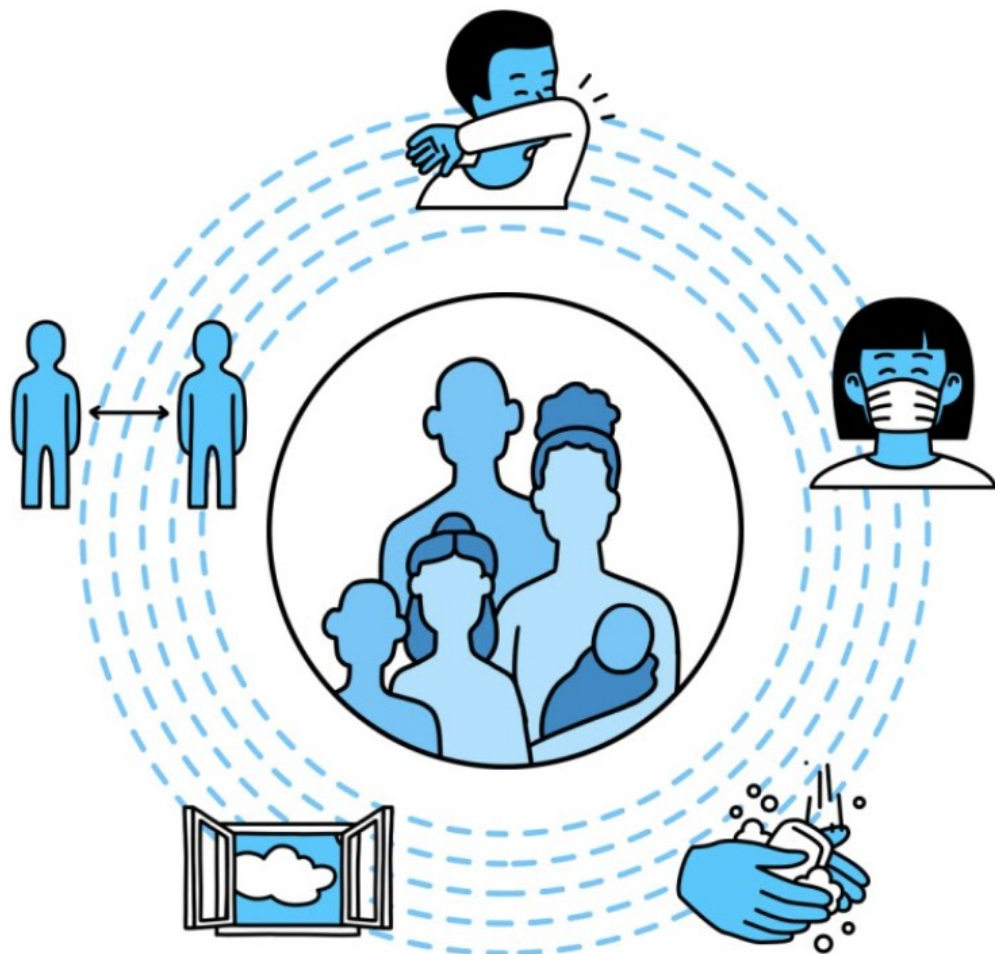
Vaccine protection and variants

When cases increase and transmission accelerates, it's more likely that new dangerous and more transmissible variants emerge, which can spread more easily or cause more severe illness.

Based on what we know so far, vaccines are proving effective against existing variants, especially at preventing severe disease, hospitalization and death. However, some variants are having a slight impact on the ability of vaccines to guard against mild disease and infection.

Vaccines are likely staying effective against variants because of the broad immune response they cause, which means that virus changes or mutations are unlikely to make vaccines completely ineffective.

WHO continues to constantly review the evidence and will update its guidance as we find out

more. For the latest updates on what we know about the COVID-19 variants, read our latest weekly epidemiological updates and our explainer on 'the effects of virus variants on COVID-19 vaccines'.

One of the best ways of guarding against new variants is to continue applying tried-and-tested public health measures and rolling out vaccines. All COVID-19 vaccines approved for emergency use listing by WHO have been thoroughly tested and proven to provide a high degree of protection against serious illness and death. As stronger virus variants emerge, it's important to take your vaccine when it's your turn.

WHEN IT'S YOUR TURN, TAKE YOUR VACCINE

All approved COVID-19 vaccines have been thoroughly tested, and all provide a high degree of protection against getting seriously ill and dying from the disease.

It is important to be vaccinated as soon as possible and not wait. This way, we build immunity in our communities faster and can get back to our normal lives.

Want to read more?

Subscribe to newsletter →