





A guide to vaccinations for COVID-19



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This guide was written in January 2021, specifically about COVID-19 vaccinations. It has been updated in October 2022 and is accurate at the time of publishing. This guide explains how vaccines work and answers your common questions, as well as providing up-to-date information on the current approved COVID-19 vaccinations in the UK. Information will be updated as it becomes available.

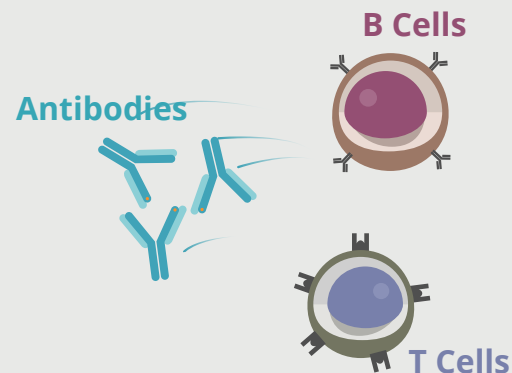
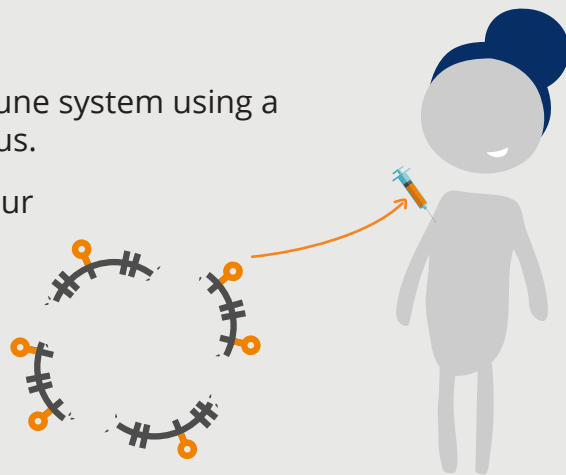
1

How vaccines work & why they're important

How do vaccines work?

Vaccines train your immune system using a harmless form of the virus.

The **vaccine** activates your immune response.



B cells that make highly specific **antibodies** to stop the virus getting into your cells.

T cells that can help stimulate the B cells and kill any infected cells.



These cells remember the virus and remain in the body. This is **immune memory**.

If you encounter the real virus in the future, your immune system responds faster and more effectively to prevent infection.

What is vaccination?

Vaccination is the safest way to protect against an infectious disease. Once you have been vaccinated, you should have the ability to fight off the infection if you come into contact with it. You will have a level of protection, or **immunity**, against the disease.

How does the immune system fight infections?

The immune system is a network of cells, tissues and organs that work together to help you fight off infection from harmful bacteria or viruses. Such disease-causing agents, including bacteria or viruses, are known as **pathogens**. When a pathogen invades your body, your immune system recognises it as harmful. Your immune system recognises unique features of the pathogen, called **antigens**, which will trigger an immune response.

Your immune system has many ways to fight off an infection. One of the ways is for specialised immune cells called **B cells** to create proteins called **antibodies**. These antibodies act as scouts, hunting down the pathogen, sticking to its antigens and marking it for destruction by the immune system or preventing it from entering your cells. Each antibody is specific to the pathogen that it has detected, matching precisely the shape of the antigen and triggering a specific immune response. Another way the immune system fights off infection is by activating other specialised immune cells called **T cells**, which can attack and kill any cells that are infected with the pathogen.

If your immune system wins the fight against the harmful pathogen, then these specific B cells and their antibodies and T cells will remain in the body after the infection has gone as memory cells. This means that if the same pathogen is encountered again, your immune system has a '**memory**' of the pathogen and is ready to quickly destroy it before you get sick and any symptoms can develop. Sometimes, however, the immune system doesn't always

win this initial battle and you can become very ill with serious complications or in extreme cases die.

The virus which causes COVID-19 is called SARS-CoV-2. The immune response to infection with SARS-CoV-2 varies between individuals. In some cases, the person has no symptoms and feels well but in others, they get very sick and it can lead to admission to hospital, intensive care and in some cases death. The disease caused by SARS-CoV-2, COVID-19, can affect multiple organs across the body and is not limited to only the lungs and respiratory system. Some people can also suffer long-term effects from COVID-19 and take many months to feel well again – this is called 'long COVID'. We still have lots to learn about why this happens.

Vaccines have been developed to train your immune system and protect against infectious diseases and their serious complications.

How does vaccination work?

Vaccination is the safest way to gain immunity against a pathogen that your body has yet to encounter. Vaccines contain a harmless form of the bacteria or virus that causes the disease you are being immunised against. Your immune system will still recognise the harmless form of the bacteria or virus in the vaccine without making you sick and will produce a specific immune response to fight it off. The immune system then maintains a memory of the bacteria or virus, so if a vaccinated person encounters the bacteria or virus later, their immune system is already prepared to fight it off quickly and prevent an infection from developing.

Is it better to gain immunity through infection?

No. When infected with SARS-CoV-2, you become infectious to other people around you and can spread the disease. Infection poses a serious risk to your health, potentially

making you very ill and causing long-term health effects. As previously mentioned, we are still understanding the long-term health consequences of COVID-19 that may be serious for a long time. Vaccination allows you to build up immunity in a safe and controlled way without becoming ill with COVID-19 and passing the virus to others.

Types of vaccines for COVID-19

There are a wide range of approaches being used to develop vaccines against the SARS-CoV-2 virus, which causes COVID-19.

There are four COVID-19 vaccines currently approved and in use in the UK and available via vaccination services. The Pfizer/BioNTech vaccine and the Moderna vaccine, which are both mRNA vaccines, the AstraZeneca/Oxford vaccine, which is a viral vector vaccine, and the Novavax vaccine, which is a protein vaccine. More information about these vaccines can be found in later sections of this guide.

The Janssen vaccine for COVID-19, which is a viral vector vaccine, has also been approved in the UK but is not currently being used in the vaccination programme.

The Valneva vaccine for COVID-19, which is an inactivated protein-based vaccine has also been approved in the UK but is not currently being used in the vaccination programme.

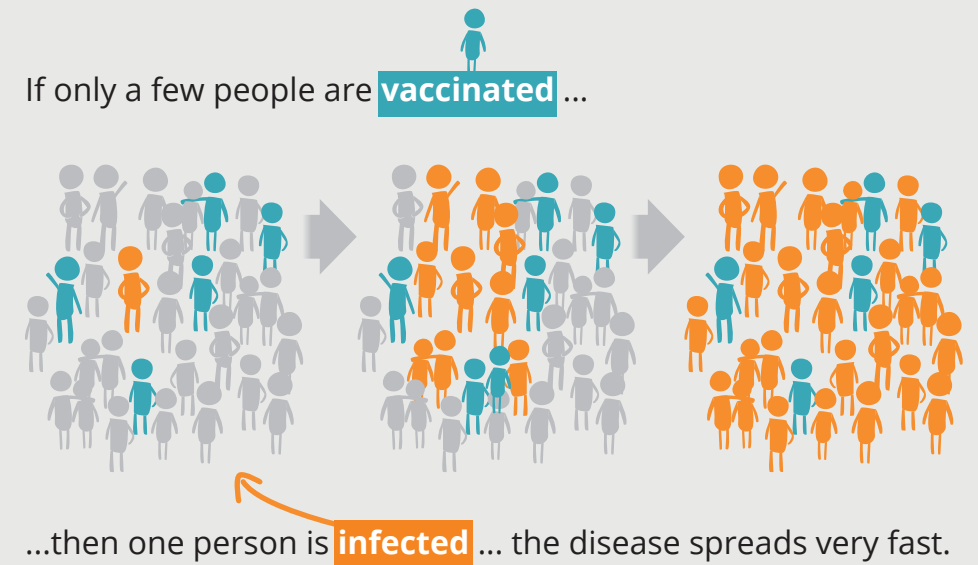
What is 'herd immunity'?

Infectious diseases are often easily passed from person to person and entire communities can rapidly become infected. If a high enough proportion of a community is protected by vaccination, it makes it difficult for the disease to spread because the number of people who can be infected is so small.² This type of protection is known as '**herd immunity**'. Herd immunity is particularly crucial

for protecting some individuals who are unable to receive vaccines, such as those that are too young, or undergoing certain medical treatment (such as for cancer). By getting vaccinated, you're not only protecting yourself, but you are also protecting the most vulnerable in your community.

For vaccines that prevent transmission of infectious diseases, a high percentage of the community needs to be vaccinated. There is now evidence that the COVID-19 vaccines reduce transmission and so can provide some protection through herd immunity.

Herd immunity



2

Common questions about vaccines for COVID-19

What are COVID-19 vaccines made of?

Each vaccine will be made up of slightly different ingredients depending on how the vaccine has been developed. The active ingredient in a vaccine is a very small amount of a harmless form of the bacteria or virus you are vaccinating against, which cannot cause disease. The role of the active ingredient is to deliver antigens to your immune system to generate a specific immune response. Vaccines for COVID-19 introduce SARS-CoV-2 antigens to your body in different ways.

The most abundant ingredient in a vaccine is water. The other ingredients in a vaccine are present in very small amounts and there is no evidence that they cause harm in these quantities (with the rare exception of people with severe allergies to some specific ingredients).

Vaccines contain very small amounts of preservatives and stabilisers, such as sorbitol and citric acid, to maintain quality and ensure the vaccine is safe to be transported and stored. These ingredients are often naturally found in the body or in food at much higher levels than in a vaccine. Preservatives are added to vaccines to prevent unwanted contamination, much like they're used in food products to stop them from spoiling. Stabilisers are also used in vaccines to stop the components separating or sticking to the vial during transportation and storage.

What's in a vaccine?



Active ingredient

A very small amount of a harmless form of the bacteria or virus you are immunising against.



Adjuvants (only found in some vaccines)

Create a stronger immune response to the vaccine. Pose no significant risk to health in the very small quantities used. COVID-19 vaccines currently used in the UK do not contain adjuvants.



Preservatives and stabilisers

Maintain vaccine quality, safe storage and prevent contamination.



Residual traces of substances that have been used during vaccine manufacture, measured as parts per million or billion in the final vaccine.



Water

The main ingredient.

Some vaccines have a very small amount of a substance added to them to help create a stronger immune response to that vaccine. These are called adjuvants. Adjuvants boost the immune response, which is particularly useful in vaccines given to older people, who have lower immune responses to vaccines. Adjuvants pose no significant risk to health in the very small quantities used in a vaccine and are often found in foods and other medicines at much larger quantities. Currently only one COVID-19 vaccine approved in the UK contains an adjuvant: the Novavax vaccine.

The AstraZeneca/Oxford vaccine contains a tiny amount of alcohol but this is less than that found in some everyday foods like bread. The ingredients found in the current COVID-19 vaccines approved for use in the UK are suitable for people of all faiths.

For a more extensive list of ingredients in each individual vaccine, you can refer to the Patient Information Leaflet (PIL) or Summary of Product Characteristics (SPC) sheet that comes with each vaccine. Both can also be found online.

Are there animal products in vaccines for COVID-19?

No. The current COVID-19 vaccines approved for use in the UK do not contain animal products.

Can people still get the disease even after they have been vaccinated?

Yes. Although vaccines are the most effective medical intervention we have for preventing disease, no medicine can ever be 100% effective. The effectiveness of each vaccine will differ depending on how it is made and the disease it is protecting you from.

Variations in individual immune systems mean that the protective capacity of any vaccine will vary between

different people, and in a very small number of cases, immunity against the disease will not fully develop. However, vaccination is extremely effective for the majority of the population.

Vaccines for COVID-19 are highly effective at preventing severe COVID-19 disease but some people can still become infected with SARS-CoV-2 after vaccination, known as a 'breakthrough' infection.

Scientists are now working hard to find out how effective vaccines are at protecting against infection with the Omicron variant of SARS-CoV-2 in the long term. Initial research shows that being fully vaccinated by having three doses of the COVID-19 vaccines boosts antibody levels significantly to provide good protection against severe disease from Omicron.

Can I get COVID-19 from the vaccines?

No. The current vaccines approved for use in the UK do not contain any active SARS-CoV-2 virus and therefore cannot give you COVID-19 disease. If you have what you think is COVID-19 after vaccination it may be that you caught COVID-19 before the vaccine had taken effect and your body had time to develop immunity. Your immune system needs time to respond to the vaccine and immunity may take up to fourteen days to develop after vaccination. Alternatively, you may have caught another virus that is not COVID-19 but has given you similar symptoms.

How long does immunity to COVID-19 last following vaccination?

Research into how long immunity lasts after COVID-19 vaccination is ongoing and complex. Length of protection can vary person to person and is dependent on which vaccines and how many doses a person has had, as well as whether they have had an infection.

Studies have shown that antibodies and T cells wane over time after two vaccine doses but this does not necessarily mean that protection is lost and the vaccines are still effective at reducing the chance of severe disease if infected after vaccination.

Analysis by the UK Health Security Agency in early 2022 showed that protection against catching the Omicron variant and having severe disease is significantly increased with a third booster dose.³⁸ However, this protection does decline with time.⁴²

Being fully vaccinated by having all offered boosters of the COVID-19 vaccines provides the best level of protection against becoming very unwell with COVID-19.

After COVID-19 vaccination, can I still pass the SARS-CoV-2 virus on to others?

Research to fully understand the effect of the vaccines in reducing spread (transmission) of the virus is ongoing. Studies into how well the vaccines prevent transmission of the Omicron variant are ongoing. Results so far looking at the Delta variant are encouraging and show vaccinated people have some reduced risk of passing on the virus, but this wanes over time.

Until we have more data, other measures are still very important to prevent the spread of the virus such as wearing a mask indoors or in crowded spaces, social distancing and hand hygiene even after vaccination.

I'm not at risk from COVID-19, why do I need a vaccine?

Even if you believe that you're not at risk of falling ill with COVID-19, it's important to remember how easily it can spread and the potential fatality. There is a huge variability in the symptoms and severity of COVID-19 between different people and while you may be in a less at-risk

group this does not mean that the infection will not be harmful to your health. Vaccines decrease your chance of developing COVID-19 and reduce how unwell you become if infected. Additionally, research has shown that people who are double vaccinated are less likely to develop long COVID should they contract COVID-19.³⁹ Getting vaccinated will also reduce the likelihood of you unknowingly passing on the virus to other people, who may be vulnerable to becoming more ill with it e.g. older relatives or those with a condition that weakens their immune system.

I currently have COVID-19, when can I get the vaccine?

You should not receive the vaccine, regardless of which dose it is, until you have recovered from COVID-19. If you are currently unwell with COVID-19 or experiencing COVID-19 symptoms, you should wait four weeks after the onset of symptoms or four weeks from the first positive test if you did not have symptoms.¹⁴ This is to avoid incorrectly associating any new symptoms or progression of symptoms to the vaccine and to allow your immune system to recover from fighting the virus so it can respond optimally to the vaccine.

I've already had COVID-19, why do I need a vaccine?

We do not yet fully know how long immunity to an infection with SARS-CoV-2 lasts and there seems to be a lot of individual variation.

Even if you've had COVID-19, vaccination will boost whatever immunity you have from previous infection. If your immunity after infection is absent or low, it can be safely boosted by vaccination.

I have long COVID, can I get the vaccine?

Long COVID is often used to describe the long-term effects of COVID-19, where some people have symptoms for

weeks or months after the infection has been cleared. Those suffering with long COVID can receive the COVID-19 vaccine and would benefit from vaccination to reduce their risk of further infection. If the person is seriously weak and unwell or their condition has recently worsened, the vaccine may not be given at that time to avoid incorrectly associating any change of symptoms to the vaccine.

Research into the effects of the vaccine on people with long COVID is ongoing. In February 2022, the UK Health Security Agency reported evidence from seven studies worldwide that examined the effects of vaccination in people with long COVID.³⁹ Most people with long COVID reported an improvement in symptoms after vaccination, either immediately or over several weeks, but some people reported a worsening of symptoms after vaccination. However, in some studies a higher proportion of people with long COVID reported unchanged symptoms following vaccination than people whose symptoms improved or worsened.

Although encouraging, this is not yet definitive and more research is needed.

Who should receive the vaccine against COVID-19 and how many doses?

In the UK, everyone over the age of 16 should receive two full doses of the COVID-19 vaccine as their primary vaccine course. This should be followed 6 months later by a third booster dose.

Young people aged 12 to 15 can receive two full doses of the COVID-19 vaccine. Children aged 5 to 11, who turned 5 before 31 August 2022, are offered two low doses of the COVID-19 vaccine. Children who turn 5 after this date are currently not eligible for vaccination against COVID-19 unless they are immunosuppressed or living with someone with a weakened immune system.⁴³

There is now a COVID-19 **booster vaccination programme for Autumn 2022**. The primary aim of the booster vaccine is to increase immunity in those at higher risk of severe COVID-19 during Winter 2022 - 2023.

The JCVI has advised that everyone aged 50 years and over, residents in a care home and health and social care workers are offered a booster vaccination in Autumn 2022. Additionally, anyone aged 5 to 49 years old in a clinical risk group, who are household members of people with immunosuppression or who are carers will also be offered a booster dose.

Is there anyone who shouldn't be vaccinated?

It is rare that someone is unable to be vaccinated. People with an allergy to any ingredients of the vaccine should not receive it.⁴ Please speak to your GP if you are offered the COVID-19 vaccine and are concerned about whether you're able to receive it.

When should I receive my COVID-19 vaccine and which one will I be offered?

For all COVID-19 vaccines in use in the UK, a two-dose primary schedule is used.

People aged 18 and over should have their second dose from 8 weeks after their first dose, whereas children and young people aged 5 to 17 should have their second dose from 12 weeks after their first dose. The third booster dose is available for everyone aged 16 and over who had their second dose at least three months ago. In Spring 2022, a fourth booster dose was offered to people aged 75 and over, care home residents and those who are immunosuppressed aged 12 and over who had their last dose at least three months ago.

The Autumn 2022 booster programme, beginning in

September 2022, will be offered to those people eligible at least three months after their previous dose.

If you're over 40 you can have any COVID-19 vaccine for your two-dose primary schedule. Boosters have to be either Pfizer/BioNTech or Moderna unless there's a medical reason those vaccines can't be given. If you're aged between 18 and 40 you'll be offered the Pfizer/BioNTech or Moderna vaccines for COVID-19. If you're under 18 you'll only be offered the Pfizer/BioNTech vaccine.

What about people with a weakened immune system?

People who are immunosuppressed as a result of underlying health conditions or medical treatments may not mount a full immune response to the standard two dose primary course of COVID-19 vaccination. Therefore, people aged 12 and over with severe immunosuppression are offered a three dose primary vaccine course, instead of the standard two. This was separate to any booster doses. The third dose was timed to be at least 8 weeks after their second, but timing can be decided by the patient and their healthcare team on an individual basis to time it around treatment in order for the vaccine to have the best chance of working.

For people in this group aged over 18 the Pfizer/BioNTech or Moderna vaccines are preferred for the third dose, whereas the Pfizer/BioNTech vaccine is preferred for 12 to 17-year-olds.

People with immunosuppression who receive three doses as their primary vaccine course will be offered further booster doses in accordance with the Spring and Autumn 2022 booster programmes.

What is a booster dose?

A **booster vaccine** is an additional vaccination given after the primary course to boost the immune response to

protect people from waning antibody levels. After booster doses were rolled out in early 2022 in the UK, real world data from January 2022 showed that in people aged 65 and over, around 3 months after they received the booster dose, there is about 90% protection against hospitalisation with COVID-19.⁴⁰

The Autumn 2022 COVID-19 booster vaccination programme aims to increase immunity in those at higher risk of severe COVID-19 during winter. Eligible people will be offered either the Pfizer/BioNTech (original or bivalent), Moderna (original or bivalent), or Novavax (in exceptional circumstances) vaccines as their Autumn 2022 booster, irrespective of the vaccines used for previous doses. An explanation of bivalent vaccines can be found on the following page.

Do vaccines for COVID-19 protect against viral variants?

A viral variant is a version of SARS-CoV-2 that has evolved and changed shape. Some viral variants can infect you even when you have immunity because your antibodies won't be as good at recognising the variant's shape. Although this can cause an infection it is likely to lead to less severe disease if you're vaccinated. Each time you are vaccinated, your immunity levels increase, giving you greater protection against severe COVID-19. Booster vaccinations are safe and effective at enhancing your immunity as they increase the level and quality of your antibodies. Getting a booster vaccine is the best protection against viral variants and severe disease.

Analysis by the UK Health Security Agency in February 2022 shows that after having two doses, protection against catching the Omicron variant of the virus and having severe disease declines after six months. However, with a third booster dose protection is restored to around 90 - 95% against hospitalisation and death.³⁹

Why are there multiple types of vaccines available for COVID-19?

To vaccinate high-risk populations around the world we'll need to produce billions of vaccine doses and this is more likely achieved through developing multiple COVID-19 vaccines. Technical and logistical challenges can be addressed with multiple vaccines. For example, the Pfizer/BioNTech vaccine needs to be stored at -70°C , which will prove difficult in many locations and settings, whereas the AstraZeneca/Oxford vaccine can be stored in a domestic fridge. Importantly, the vaccines need to be equally accessible and fairly distributed to people all around the world.

What is a bivalent vaccine?

For the Autumn 2022 booster vaccine programme, the MHRA approved two updated bivalent COVID-19 vaccines from Moderna and Pfizer/BioNTech. Bivalent means the vaccine targets two COVID-19 variants both the original SARS-CoV-2 virus and the Omicron variant. The updated vaccines have been developed to optimise protection against new variants.

The updated bivalent vaccines are both safe and effective and will be used in the Autumn 2022 booster programme. The bivalent vaccines may provide a slightly increased level of protection against current known virus variants compared with the original vaccine.⁴² However, this difference is small compared with the overall benefit from any type of booster. It is expected that circulating virus levels will rise in winter so it is important to take up the offer of a booster if eligible.

3

Common concerns about vaccines for COVID-19

Concerns over vaccine safety have allowed misconceptions and misinformation about vaccination to spread, despite there being little, if any, evidence to back them up. However, the large amount of unverified information available on the internet about vaccination can make it difficult to distinguish the facts from the myths. Here are answers to some of the most common questions and concerns about vaccines.

How do I know vaccines for COVID-19 are safe?

Before any vaccine can be given to the population it must go through rigorous testing. Like all medicines, vaccines undergo extensive clinical trials, where they are administered and monitored in groups of volunteers. In the UK, the results of the trials are then assessed by the Medicines and Healthcare products Regulatory Agency (MHRA).

No medicine can ever be completely risk free or 100% effective. However, strong licencing processes and safety tests ensure that the health benefits of medicines being given through the NHS greatly outweigh any risks. As vaccines are given to healthy people, these regulatory measures are even stricter, meaning that the level of 'acceptable risk' for vaccines is much lower than it would be for other medicines.⁶

Since rollout of the COVID-19 vaccines, their safety continues to be monitored by regulatory authorities. Millions of people around the world have now received their COVID-19 vaccines which continue to show a strong safety profile with the health benefits greatly outweighing any risks.

How do I balance my own risks versus benefits of receiving the vaccine for COVID-19?

The overall benefits of vaccination in protecting you from COVID-19 outweighs any risks of side effects for the vast majority of people. Vaccines are the best way to protect people from COVID-19, which has a far higher risk of serious health consequences. As of August 2022, over 150 million doses of vaccines against COVID-19 have been administered in the UK, saving thousands of lives.

No medicine or vaccine is completely without risk of side effects. The MHRA in the UK continually monitors safety during widespread use of any vaccine to ensure the vaccines are performing as expected, to identify any side effects that may arise, and to ensure the benefits continue to outweigh the risks.

Has the speed of developing vaccines for COVID-19 compromised safety?

No. All the standard safety procedures have been followed during clinical trials on vaccines for COVID-19 and the rigorous regulatory processes have been fully completed as for any other vaccine or medicine.

Vaccines for COVID-19 have been developed at a much faster pace due to several reasons. Vaccine development is normally a long and expensive process because of delays caused by applying for funding, obtaining ethical approval, recruiting trial volunteers, negotiating with manufacturers and scaling up production. In the emergency state of the COVID-19 pandemic the scientists, doctors, ethics approval boards, manufacturers and regulatory agencies have all come together to work harder and faster. Clinical trial phases and manufacture have been able to run in parallel to speed up the process.

Scientists have been sharing knowledge openly and promptly during the pandemic, with the SARS-CoV-2

How have vaccines for COVID-19 been developed so fast?



genetic sequence being made public very quickly by Chinese scientists. Working together across many different countries has allowed researchers to work more efficiently.

The greatest barrier to vaccine development is funding. Normally it takes years to raise money to develop a vaccine and at each stage you would have to stop and apply for more funding to carry out the next stage. In the current emergency, many governments and funding bodies have joined forces to remove those financial obstacles. This has allowed large-scale manufacturing of the vaccines to occur in parallel with the clinical trials, which would normally only happen after clinical trials are completed.

The pandemic environment has meant acceleration of clinical trials and faster results because high case rates are needed to test a vaccine's effectiveness. Additionally, tens of thousands of keen volunteers have put themselves forward for the clinical trials so recruiting enough volunteers has not been an issue as it may be under normal circumstances.

Finally, scientific advances in vaccine technology have greatly aided the speed of development. Many of the approaches are built on the back of many years of research and could be rapidly deployed once the genetic sequence of SARS-CoV-2 became known.

How are long-term side effects known when a vaccine is new?

When any vaccine or medicine is approved, it is continuously and closely monitored for safety and effectiveness by the MHRA. Any suspected side effects are reported by medical providers or patients to the MHRA using the yellow card scheme. Cases of suspected side effects are investigated promptly, while precautionary advice is given and if necessary, advice is modified. You can find the yellow card scheme website at the end of this booklet.

Vaccines for COVID-19 were monitored in large numbers of people for many months in clinical trials and no major safety concerns arose. Most side effects of vaccines appear at the time of vaccination or very soon after, within days or weeks, and are minor and temporary. The vaccines for COVID-19 had been monitored for long enough in clinical trials for the MHRA to find the vaccines safe. In addition, we now have all the long-term safety data from the many millions of doses of COVID-19 vaccines that have been administered over the past years all around the world.

Short-term side effects include soreness and swelling at the site of injection, tiredness or a slight fever, but these are not long-lasting. These side effects are in fact evidence that the immune system is responding to the vaccine as it should be. Long-term side effects appear to be very rare but to be ultra-cautious, the MHRA will continue to monitor for them.

Do the vaccines for COVID-19 affect fertility?

There is no evidence that the vaccines for COVID-19 harm fertility or reduce the chances of becoming pregnant. Although clinical trial participants were asked to avoid becoming pregnant, 102 pregnancies occurred across the trials of the four vaccines that have so far been approved in the UK. There was no significant difference in the rate of accidental pregnancies in the vaccinated groups compared with the control groups, which indicates that the vaccines do not prevent pregnancy in humans.¹⁹

Following vaccine rollout, further data about the effect of the vaccines on fertility has been collected. In the USA, where they are actively collecting data on pregnancies, by July 2021 over 10,000 people who had at least one dose of the COVID-19 vaccine had reported a pregnancy. Additionally, studies looking at pregnancy in people undergoing IVF treatment found no difference in pregnancy

rates in vaccinated people compared to unvaccinated people.

Are the COVID-19 vaccines safe in pregnancy?

COVID-19 vaccination is recommended in pregnancy and it's the best way to protect yourself and your unborn baby from the known risks of COVID-19 during pregnancy. You don't have to wait for a particular time in your pregnancy to get the COVID-19 vaccine. You can get the vaccine as soon as possible when it's convenient for you.

Evidence from 24 studies, in 8 countries, including over 270,000 people vaccinated in pregnancy show that COVID-19 vaccination in pregnancy is associated with no increased risk of miscarriage, preterm birth, stillbirth, complications at birth, congenital abnormalities or the baby being born smaller than expected.

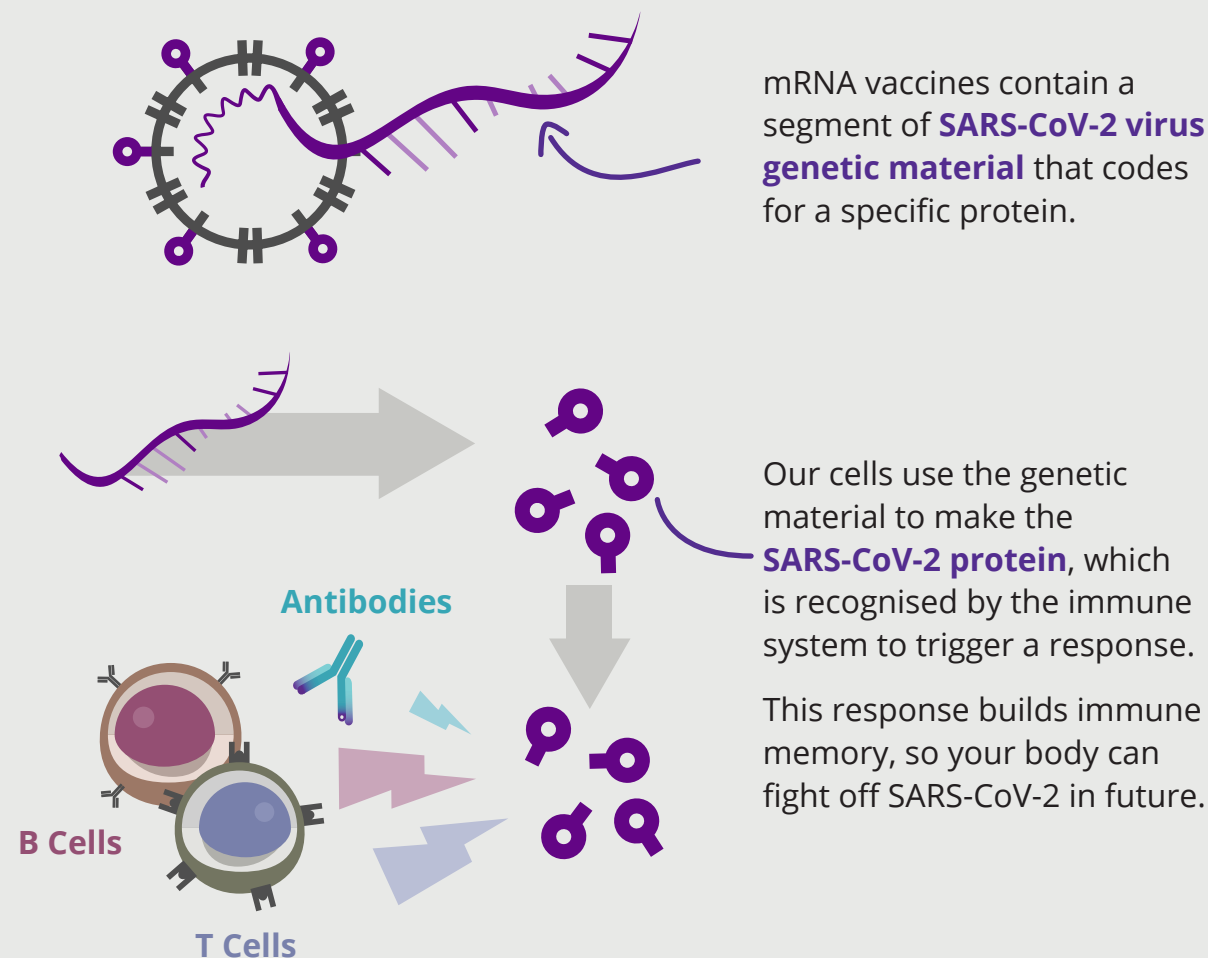
Will drinking alcohol impact on the effectiveness of the vaccine?

There is no evidence that moderate alcohol intake either prior to or after COVID-19 vaccination will affect your immune response to the vaccine. While drinking to excess regularly is bad for your health generally and can affect immunity, consuming alcohol within the weekly recommended limit will not impact the effectiveness of the vaccine.

4

Common questions about the Pfizer/BioNTech vaccines for COVID-19

How do mRNA vaccines work?



How does the Pfizer/BioNTech COVID-19 vaccine work?

This vaccine is an mRNA vaccine. The virus itself is not used in this type of vaccine.

The vaccine contains a segment of the SARS-CoV-2 virus genetic material that codes for a specific protein from the virus, which is the spike protein on the surface of the virus. The genetic material in the vaccine is mRNA, which is used as instructions for the cell to make proteins.

When the vaccine is given, our cells at the site of injection take up the mRNA and make the SARS-CoV-2 protein. The mRNA from the vaccine is subsequently destroyed by the body. The protein produced is then recognised by the immune system and triggers a specific response. This response builds immune memory so that your immune system is ready to quickly fight off SARS-CoV-2 in the future and prevent you from getting sick with COVID-19.

What are the other names for this vaccine?

The Pfizer/BioNTech COVID-19 vaccine may be called by its brand name 'Comirnaty'. It's also known in the UK as the COVID-19 mRNA Vaccine BNT162b2.

Can mRNA vaccines alter my DNA?

No. The mRNA delivered by the vaccine cannot enter the nucleus of your cells, where your DNA is stored, and will degrade naturally within hours. At no point is your DNA interfered with.

This is a new technology; how do I know it is safe?

This technology seems new but is built on the back of many years of research. mRNA vaccines for some cancers and rabies have been in clinical trials in humans for years with promising results and no major safety concerns.⁷ Once the genetic sequence of SARS-CoV-2 became known, this

vaccine technology was adapted quickly to target the new virus.

The MHRA has thoroughly assessed the clinical trial data and deemed it safe for use. The original clinical trial data was published in the peer-reviewed and reputable journal called *The New England Journal of Medicine*.⁸ We now have published data following participants for over six months after vaccination with no safety concerns and safety monitoring of all trial participants will continue for two years after administration of the second dose of the vaccine.

The MHRA in the UK and other regulatory authorities around the world have also been carrying out independent safety monitoring after the vaccine was released. As of August 2022, over 81 million doses of the Pfizer/BioNTech vaccine have been administered in the UK and it has a good safety profile. The benefits of the vaccine outweigh the risks in the majority of people.

Will the Pfizer/BioNTech vaccine have side effects?

The most common side effects experienced by vaccine recipients is mild-to-moderate pain at the injection site, fatigue and headache which resolve within a few days. These expected side effects happen shortly after vaccination and are not associated with serious or lasting illness.

Very rare side effects reported after receiving this vaccine are inflammation of the heart muscle (myocarditis) and inflammation of the lining outside of the heart (pericarditis). These conditions develop within a few days and usually within 14 days after vaccination. After vaccination you should be aware of the signs of myocarditis and pericarditis such as breathlessness, palpitations and chest pain, and seek immediate medical attention if you experience these symptoms following vaccination.

How effective is the Pfizer/BioNTech vaccine and what does that mean?

Over 43,000 people participated in the original clinical trials which found that, seven days after the second dose, the vaccine was 95% effective in preventing people getting sick with COVID-19.⁸ Importantly, no one who received the vaccine suffered severe disease; the vaccine prevents the most severe cases of COVID-19. Similar vaccine efficacy (generally 90 - 100%) was found across different groups of people. Age, sex, race, ethnicity, baseline body-mass index, and the presence of other health conditions did not affect the vaccine's effectiveness.

Since vaccine rollout began in the UK, real-world evidence has shown that after two doses, the Pfizer/BioNTech vaccine is 80 - 95% effective at preventing symptomatic disease from the Delta variant. However, since Omicron became the dominant viral variant in the UK new research has shown that although two doses of the Pfizer/BioNTech vaccine provides good protection against severe disease and hospitalisation with Omicron infection, the effectiveness of the vaccine is reduced compared to the protection provided against the Delta variant. Analysis by the UK Health Security Agency in February 2022 shows that with a third booster dose protection is restored to around 90 - 95% against hospitalisation and death.³⁸

Receiving a booster dose is the best protection against viral variants and severe COVID-19.

Who should not receive this vaccine for COVID-19?

The vaccine should not be given to people who have a history of immediate-onset anaphylaxis (serious allergic reaction) to any ingredients of the vaccine, multiple classes of drugs or an unexplained anaphylaxis.⁴ Some other mild allergies, such as hay fever or food allergies, do not pose a risk to a dangerous response to the vaccine.

Can pregnant people receive the Pfizer/BioNTech vaccine?

Yes, pregnant people in the UK can receive this vaccine and COVID-19 vaccination is recommended in pregnancy. You don't have to wait for a particular time in your pregnancy, you can get the vaccine as soon as it's convenient for you. There is now more evidence of the risks associated with catching COVID-19 for pregnant people and so the benefit of vaccination to protect pregnant people against COVID-19 is substantial. Pregnant people with COVID-19 are more likely to need intensive care and to deliver their babies preterm compared to pregnant people without COVID-19. Their babies are also more likely to be admitted to the neonatal unit.²⁴

As of January 2022, 180,000 pregnant people have been vaccinated for COVID-19 in the USA and 100,000 in the UK with no safety signals appearing in reporting. In clinical research specifically looking at pregnant people who have received their COVID-19 vaccination, 24 studies, in 8 countries, including over 270,000 people vaccinated in pregnancy show that there is no increased risk of miscarriage, preterm birth, stillbirth, complications at birth, congenital abnormalities or babies being born smaller than expected.

It is safe to have the vaccine if you are breastfeeding.

Can children receive the Pfizer/BioNTech vaccine?

All 12 to 15-year-olds in the UK are offered two doses of this vaccine. Children aged 5 to 11, who turned 5 before 31 August 2022, will also be offered two low doses of this vaccine. Children who turned 5 after 31 August 2022 are only eligible for vaccination against COVID-19 if they are immunosuppressed, or live with someone with a weakened immune system.⁴³

Millions of children and young people around the world have now had a COVID-19 vaccine. The MHRA extensively

reviewed the safety and effectiveness of this vaccine in this age group and confirmed that vaccination is safe and effective for children.

A recent study in UK children aged 12 to 17 years reported that after even a single dose of the Pfizer/BioNTech vaccine, there was a significant and rapid reduction in the risk of COVID-19 infection. The data also showed that a single dose made infection with the Delta variant milder and shorter in duration, although these benefits declined with Omicron infection.⁴¹

Is the Pfizer/BioNTech vaccine used as a booster?

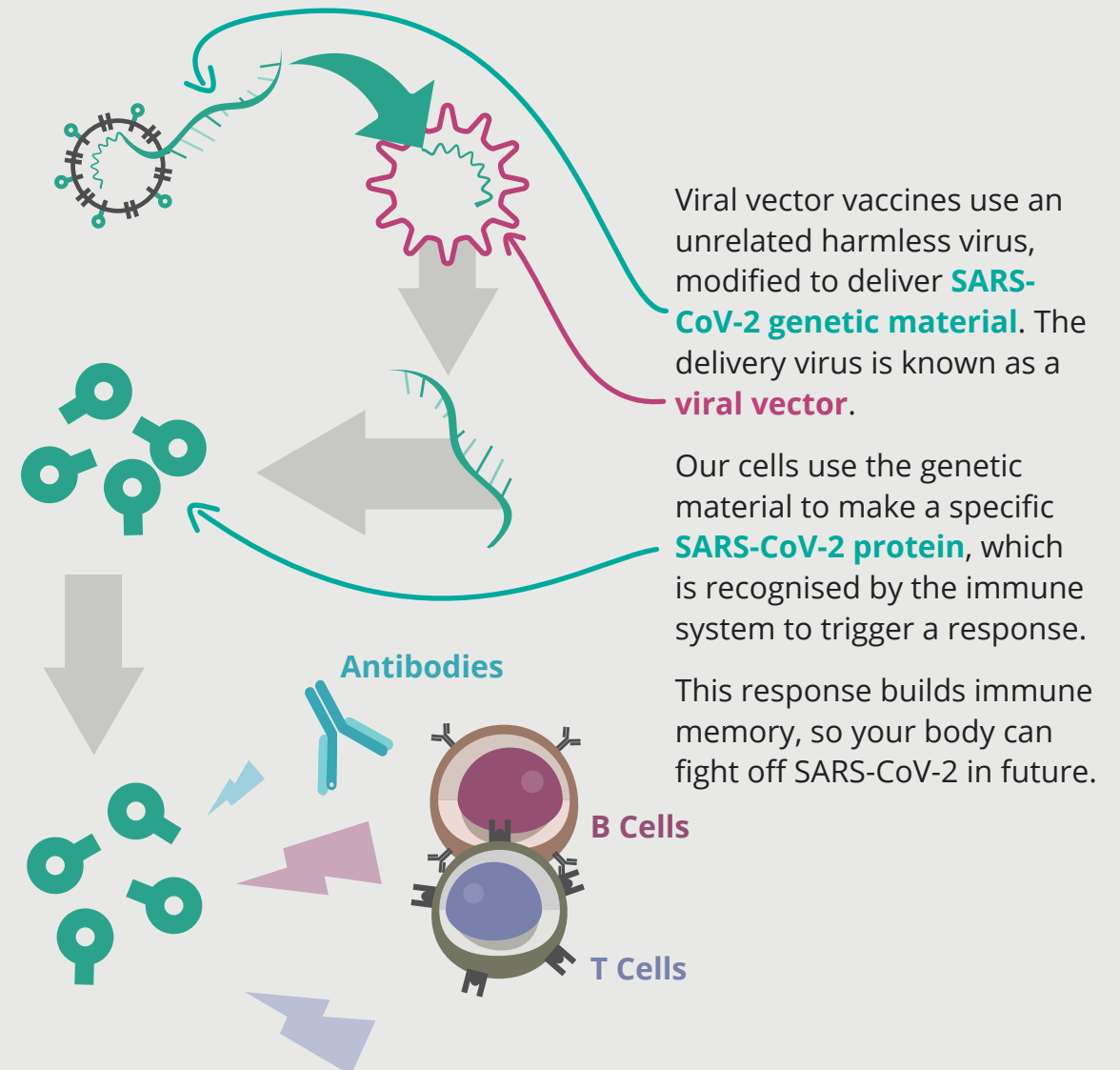
In Autumn 2022 both the Pfizer/BioNTech original and bivalent vaccines will be offered as boosters to eligible people. The bivalent vaccine targets both the original SARS-CoV-2 virus and the Omicron variant. Whilst the bivalent vaccine may give a slightly better protection against the Omicron variant, all approved vaccines still give good protection to all current variants of COVID-19. If you are offered a booster it is important to take it up irrespective of which vaccine is used.

It is safe to have the Pfizer/BioNTech monovalent or bivalent vaccine as your booster dose irrespective of the vaccines used for previous doses.

5

Common questions about the AstraZeneca/Oxford vaccine for COVID-19

How do viral vector vaccines work?



How does the AstraZeneca/Oxford COVID-19 vaccine work?

This vaccine is a viral vector vaccine. The virus itself is not used in this type of vaccine.

The vaccine uses an unrelated and harmless virus which has been modified to act as a delivery system to carry the SARS-CoV-2 virus genetic material. The genetic material is a segment of SARS-CoV-2 DNA that codes for the specific spike protein from the SARS-CoV-2 virus. The delivery virus is known as a viral vector. In this vaccine, the viral vector is a weakened chimpanzee adenovirus, which normally causes the common cold in chimpanzees and has been changed so it cannot grow in humans.

When the vaccine is given, our cells at the site of injection take up the viral vector and the SARS-CoV-2 genetic material is delivered so the cell can make the SARS-CoV-2 protein. The viral vector from the vaccine is subsequently destroyed by the body. The protein produced is then recognised by the immune system and triggers a specific response. This response builds immune memory so that your immune system is ready to quickly fight off SARS-CoV-2 in the future and prevent you from getting sick with COVID-19.

What are the other names for this vaccine?

The AstraZeneca/Oxford vaccine is also known by its brand name 'Vaxzevria' and it may sometimes be referred to as the COVID-19 Vaccine ChAdOx1-SARS-COV-2.

Can a viral vector vaccine alter my DNA?

No. The adenovirus as well as the DNA delivered by it in the vaccine cannot enter the nucleus of your cells, where your DNA is stored, and will degrade naturally within hours. At no point is your DNA interfered with.

This is a new technology; how do I know it is safe?

This technology seems new but is built on the back of many years of research. Viral vector vaccines have been developed and approved for the prevention of Ebola after years of clinical trials in humans with successful results and no safety concerns.^{10,11} The research team at Oxford University were already working on pandemic preparedness, using this vaccine technology to fight emerging diseases. Once the genetic sequence of SARS-CoV-2 became known, the technology was adapted quickly to target the new virus.

The MHRA has thoroughly assessed the clinical trial data and deemed it safe for use. The clinical trial data was published in the peer-reviewed and reputable journal called *The Lancet*.¹² The published data followed participants for between two to six months after vaccination with no safety concerns and safety monitoring of all trial participants will continue for 12 months.

The MHRA in the UK and other regulatory authorities around the world have also been carrying out independent safety monitoring after the vaccine was released. As of March 2022, over 50 million doses of the AstraZeneca/Oxford vaccine have been administered in the UK and it has a good safety profile. The benefits of the vaccine outweigh the risks in the majority of people.

Will the AstraZeneca/Oxford vaccine have side effects?

The most common side effects experienced by COVID-19 vaccine recipients is pain at the injection site, fatigue, muscle aches, feeling feverish and headache which resolve within a few days.

There are very rare reports of individuals developing blood clots with low platelet counts after receiving this vaccine and the JCVI decided to take a careful, proactive approach to advise people under 40 with no other health conditions

to be offered an alternative vaccine to the AstraZeneca/Oxford vaccine where available. The reason for this shift in emphasis for younger people is because the benefit to risk ratio is less pronounced than in older people who are at higher risk of severe COVID-19 disease.

After vaccination you should be aware of the signs of blood clots. If you experience any of the following from four days to four weeks after vaccination, you should seek medical advice urgently:

- a new, severe headache which is not helped by usual painkillers or is getting worse
- an unusual headache which seems worse when lying down or bending over or may be accompanied by
- blurred vision, nausea and vomiting
- difficulty with your speech
- weakness, drowsiness or seizures
- new, unexplained pinprick bruising or bleeding
- shortness of breath, chest pain, leg swelling or persistent abdominal pain³⁰

How effective is the AstraZeneca/Oxford vaccine and what does that mean?

Almost 11,700 people took part in the original reported clinical trials.¹² Of the people in the trial who received the COVID-19 vaccine, 88% were aged between 18 and 55, 12% were aged over 55, 17% were from ethnic minority backgrounds, 39% were male. The trial found that, fourteen days after the second dose, the vaccine was 62% effective in preventing people getting sick with COVID-19. Importantly, no one who received the vaccine suffered from severe COVID-19 disease; the vaccine prevents the most severe cases of COVID-19.

Since vaccine rollout began in the UK, real-world evidence has shown that after two doses, the AstraZeneca/Oxford vaccine is 65 - 70% effective at preventing symptomatic disease from the Delta variant. However, since Omicron became the dominant viral variant in the UK new research has shown that although two doses of the AstraZeneca/Oxford vaccine provides good protection against severe disease and hospitalisation with Omicron infection, the effectiveness of the vaccine is reduced compared to the protection provided against the Delta variant. Analysis by the UK Health Security Agency in February 2022 shows that with a third booster dose of a Pfizer/BioNTech or Moderna COVID-19 vaccine, protection is restored to around 90 - 95% against hospitalisation and death.³⁸ Receiving a booster dose is the best protection against viral variants and severe COVID-19.

Who should not receive this vaccine for COVID-19?

In the UK, people under the age of 40 will be offered an alternative vaccine to the AstraZeneca/Oxford vaccine where available.²⁰

Anyone with a medical history of heparin-induced thrombocytopenia and thrombosis should not receive the AstraZeneca/Oxford vaccine and will be offered an alternative. People who have previously had a blood clot should be reassured that they can still get the AstraZeneca/Oxford vaccine when offered.³³

Anyone who experienced cerebral or other major blood clots occurring with low levels of platelets after their first dose of the AstraZeneca/Oxford vaccine should have further vaccination delayed until their clotting has completely stabilised and they should be considered for an alternative vaccine for their second dose.³³ Anyone who did not have these side effects after their first dose, can have their second dose of the AstraZeneca/Oxford vaccine.²¹

The vaccine should not be given to people who have a history of immediate-onset anaphylaxis (serious allergic reaction) to any ingredients in the vaccine.⁴

Is the AstraZeneca/Oxford vaccine used as a booster?

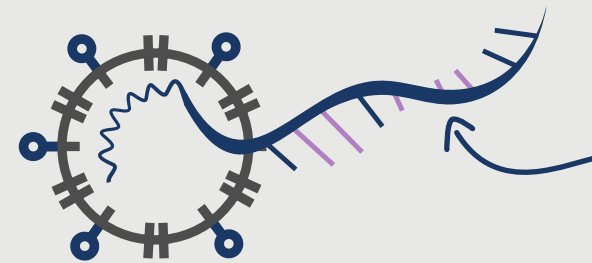
The AstraZeneca/Oxford vaccine is not used as booster vaccine.

If you had the AstraZeneca/Oxford vaccine as your first and second dose, it is safe to have the booster dose with a different vaccine.

5

Common questions about the Moderna vaccines for COVID-19

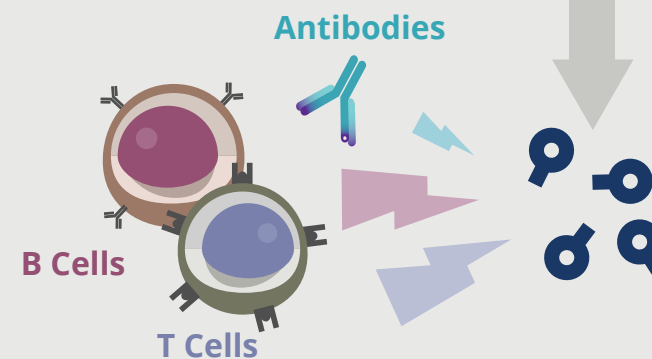
How do mRNA vaccines work?



mRNA vaccines contain a segment of **SARS-CoV-2 virus genetic material** that codes for a specific protein.



Our cells use the genetic material to make the **SARS-CoV-2 protein**, which is recognised by the immune system to trigger a response.



This response builds immune memory, so your body can fight off SARS-CoV-2 in future.

How does the Moderna COVID-19 vaccine work?

This vaccine is an mRNA vaccine. The virus itself is not used in this type of vaccine.

The vaccine contains a segment of the SARS-CoV-2 virus genetic material that codes for a specific protein from the virus, which is the spike protein on the surface of the virus. The genetic material in the vaccine is mRNA, which is used as instructions for the cell to make proteins.

When the vaccine is given, our cells at the site of injection take up the mRNA and make the SARS-CoV-2 protein. The mRNA from the vaccine is subsequently destroyed by the body. The protein produced is then recognised by the immune system and triggers a specific response. This response builds immune memory so that your immune system is ready to quickly fight off SARS-CoV-2 in the future and prevent you from getting sick with COVID-19.

What are the other names for this vaccine?

The Moderna COVID-19 vaccine is also known by its brand name 'Spikevax'.

Can mRNA vaccines alter my DNA?

No. The mRNA delivered by the vaccine cannot enter the nucleus of your cells, where your DNA is stored, and will degrade naturally within hours. At no point is your DNA interfered with.

This is a new technology; how do I know it is safe?

This technology seems new but is built on the back of many years of research. mRNA vaccines for some cancers and rabies have been in clinical trials in humans for years with promising results and no major safety concerns.⁷ Once the genetic sequence of SARS-CoV-2 became known, this

vaccine technology was adapted quickly to target the new virus.

The MHRA has thoroughly assessed the clinical trial data and deemed it safe for use. The preliminary clinical trial data was published in the peer-reviewed and reputable journal called *The New England Journal of Medicine*.¹³ The published preliminary data followed participants for two months after vaccination with no safety concerns and safety monitoring of all trial participants will continue.

The MHRA in the UK and other regulatory authorities around the world have also been carrying out independent safety monitoring after the vaccine was released. As of March 2022, over 12 million doses of the Moderna vaccine have been administered in the UK and it has a good safety profile. The benefits of the vaccine outweigh the risks in the majority of people.

Will the Moderna vaccine have side effects?

The most common side effects experienced by vaccine recipients is pain at the injection site, fatigue, muscle aches, joint pain and headache which resolve within a few days. These expected side effects happen shortly after vaccination and are not associated with serious or lasting illness.

Very rare side effects reported after receiving this vaccine are inflammation of the heart muscle (myocarditis) and inflammation of the lining outside of the heart (pericarditis). These conditions develop within a few days and usually within 14 days after vaccination. After vaccination you should be aware of the signs of myocarditis and pericarditis such as breathlessness, palpitations and chest pain, and seek immediate medical attention if you experience these symptoms following vaccination.

How effective is the Moderna vaccine and what does that mean?

Over 30,000 people participated in the original clinical trials which found that, at least fourteen days after the second dose, the vaccine was 94% effective in preventing people getting sick with COVID-19.¹³ Importantly, no one who received the vaccine suffered from severe disease; the vaccine prevents the most severe cases of COVID-19.

Similar vaccine efficacy was found across different groups of people with age, sex, presence of other health conditions that increase risk of severe COVID-19, race and ethnicity, not affecting the vaccine's effectiveness.

Since vaccine rollout began in the UK, real-world evidence has shown that after two doses, the Moderna vaccine is 80 - 95% effective at preventing symptomatic disease from the Delta variant. However, since Omicron became the dominant viral variant in the UK new research has shown that although two doses of the Moderna vaccine provides good protection against severe disease and hospitalisation with Omicron infection, the effectiveness of the vaccine is reduced compared to the protection provided against the Delta variant. Analysis by the UK Health Security Agency in February 2022 shows that with a third booster dose of a Pfizer/BioNTech or Moderna COVID-19 vaccine, protection is restored to around 90 - 95% against hospitalisation and death.³⁸ Receiving a booster dose is the best protection against viral variants and severe COVID-19.

Who should not receive this vaccine for COVID-19?

The vaccine should not be given to people who have a history of immediate-onset anaphylaxis (serious allergic reaction) to any ingredients in the vaccine.⁵

Is the Moderna vaccine used as a booster?

In Autumn 2022 both the Moderna original and bivalent vaccines will be offered as boosters to eligible people. The bivalent vaccine targets both the original SARS-CoV-2 virus and the Omicron variant. Whilst the bivalent vaccine may give a slightly better protection against the Omicron variant, all approved vaccines still give good protection to all current variants of COVID-19. If you are offered a booster it is important to take it up irrespective of which vaccine is used.

It is safe to have the Moderna monovalent or bivalent vaccine as your booster dose irrespective of the vaccines used for previous doses.

Can pregnant people receive the Moderna vaccine?

Yes, pregnant people in the UK can receive this vaccine and COVID-19 vaccination is recommended in pregnancy. You don't have to wait for a particular time in your pregnancy, you can get the vaccine as soon as it's convenient for you. There is now more evidence of the risks associated with catching COVID-19 for pregnant people²⁴ and so the benefit of vaccination to protect pregnant people against COVID-19 is substantial. Pregnant people with COVID-19 are more likely to need intensive care and to deliver their babies preterm compared to pregnant people without COVID-19. Their babies are also more likely to be admitted to the neonatal unit.²⁴

As of January 2022, 180,000 pregnant people have been vaccinated for COVID-19 in the USA and 100,000 in the UK with no safety signals appearing in passive reporting. In clinical research specifically looking at pregnant people who have received their COVID-19 vaccination, 24 studies in 8 countries, including over 270,000 vaccinated in pregnancy show that there is no increased risk of miscarriage,

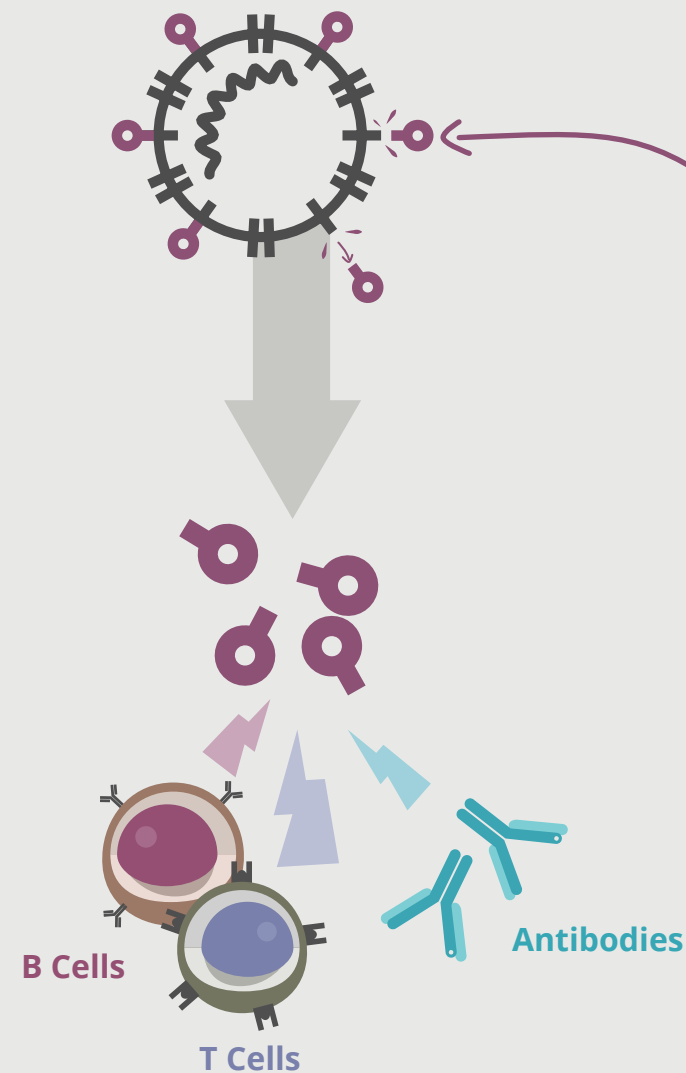
preterm birth, stillbirth, complications at birth, congenital abnormalities or babies being born smaller than expected.

It is safe to have the vaccine if you are breastfeeding.

6

Common questions about the Novavax vaccine for COVID-19

How do protein vaccines work?



Protein vaccines contain **proteins** from the SARS-CoV-2 virus, which are recognised by the immune system to trigger a response.

They can be whole proteins, protein fragments, or many protein molecules packed into nanoparticles.

This response builds immune memory, so your body can fight off SARS-CoV-2 in future.

How does the Novavax COVID-19 vaccine work?

This vaccine is a protein-based vaccine. The vaccine contains a version of the spike protein, found on the surface of the SARS-CoV-2 virus. The virus itself is not used in this vaccine.

When the vaccine is given, the injected protein is identified by the immune system and causes a specific response. This response builds immune memory so that your immune system is ready to fight off SARS-CoV-2 in the future and prevents you from getting sick with COVID-19.

Does it contain an adjuvant?

Yes, the Novavax vaccine is the only vaccine currently approved in the UK that uses an adjuvant. Adjuvants are substances, added in small amounts, that help strengthen the immune response triggered after vaccination. The adjuvant used in the Novavax vaccine is called Matrix-M, it is completely safe, and is a substance derived from saponin. Saponins are found in many different plants, including vegetables like green beans. Matrix-M is based on a saponin found in soap tree bark and is a safe and effective vaccine adjuvant.

What are the other names for this vaccine?

The Novavax vaccine may also be called its commercial name: Nuvaxovid.

How do I know it's safe?

This type of vaccine has been in use for a long time, other vaccines such as the Hepatitis B vaccine also use protein technology and they have good safety records.

The MHRA has thoroughly assessed the clinical trial data and deemed it safe for use. The vaccine has been in use in several countries, and regulatory authorities around

the world, including the MHRA, have been carrying out independent safety monitoring since its release. As of September 2022, over 1 million doses of the Novavax vaccine have been administered around the world and it has a good safety profile. The benefits of vaccination outweigh the risks in the majority of people.

Will the Novavax vaccine have side effects?

The most common side effects after Novavax vaccination are tenderness or pain at site of injection, tiredness, muscle pain, headache, joint pain, and nausea or vomiting. These side effects are usually mild to moderate and resolve within a few days.

Very rare side effects reported after receiving this vaccine are inflammation of the heart muscle (myocarditis) and inflammation of the lining outside of the heart (pericarditis). These conditions develop within a few days and usually within 14 days after vaccination. After vaccination you should be aware of the signs of myocarditis and pericarditis such as breathlessness, palpitations and chest pain, and seek immediate medical attention if you experience these symptoms.

How effective is the Novavax vaccine, and what does that mean?

Over 49,000 people participated in the 5 clinical trials that took place in the UK, USA, Australia, Mexico and South Africa. These studies found that, seven days after the second dose, the vaccine was 90.4% effective in preventing people getting sick with COVID-19.⁴⁴ Importantly, no one who received the vaccine suffered severe disease; the vaccine prevents the most severe cases of COVID-19. Similar vaccine efficacy (generally 82-95%) was found across different groups of people.⁴⁴ Age, sex, race, ethnicity, baseline body-mass index, and the presence of other

health conditions did not affect the vaccine's effectiveness.

This vaccine will be used in the UK as part of the Autumn 2022 booster programme. Receiving a booster is the best protection against viral variants and severe COVID-19.

Will it be used as a booster, and who will receive it?

Yes, the Novavax vaccine has been approved for use in the Autumn 2022 booster programme.

The Novavax vaccine will only be used in exceptional circumstances in people over the age of 12. You will receive the Novavax vaccine if you have previously had severe adverse reactions to the Pfizer/BioNTech or Moderna vaccines.

Can children have the Novavax vaccine?

Novavax has been approved for use in children over the age of 11 but will not be used in the Autumn 2022 booster programme. Millions of children and young people around the world have now had a COVID-19 vaccine. The MHRA extensively reviewed the safety and effectiveness of this vaccine in this age group and confirmed that vaccination is safe and effective for children.

Can pregnant people receive the Novavax vaccine?

Yes, pregnant people in the UK can receive this vaccine and COVID-19 vaccination is recommended in pregnancy. However, the Novavax vaccine will only be offered to people unable to have either Pfizer/BioNTech or Moderna COVID-19 vaccines. You don't have to wait for a particular time in your pregnancy, you can get the vaccine as soon as it's convenient for you. There is now more evidence of the risks associated with catching COVID-19 for pregnant people and so the benefit of vaccination to protect pregnant people against COVID-19 is substantial. Pregnant people with COVID-19 are more likely to need intensive

care and to deliver their babies preterm compared to pregnant people without COVID-19. Their babies are also more likely to be admitted to the neonatal unit.²⁴

It is safe to have the vaccine if you are breastfeeding.

Who should not receive this vaccine?

The vaccine should not be given to people under the age of 11, or to anyone with a history of immediate-onset anaphylaxis (serious allergic reaction) to any ingredients of the vaccine, multiple classes of drugs or an unexplained anaphylaxis.⁴ Some other mild allergies, such as hay fever or food allergies, do not pose a risk to a dangerous response to the vaccine.

If you have received a flu vaccine, you must wait 7 days before getting a Novavax COVID-19 vaccine. This also applies the other way around, you must wait 7 days after a Novavax COVID-19 vaccine to receive a flu vaccine. This is to maximise the effectiveness of both vaccines.

Additional resources

The full reference list for this leaflet can be found online
www.immunology.org/guide-covid-vaccines/references

British Society for Immunology
<https://www.immunology.org>

WHO website – COVID-19 vaccines
<http://bit.ly/WHOCovidvaccine>

NHS website – COVID-19 vaccines
<http://bit.ly/NHSCovidvaccine>

NHS website – why vaccination is safe and important
<http://bit.ly/NHSSafe>

MHRA yellow card scheme
<https://yellowcard.mhra.gov.uk>

If you have any questions about vaccines, ask your GP, nurse or other healthcare professionals.



The British Society for Immunology's mission is to support our immunology community in driving scientific discovery and making a positive impact on health.

We are grateful to all our members who contributed to this booklet.

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