British Society for immunology

A guide to vaccinations for adults over 65

Contents

This guide was written in November 2022, specifically about vaccinations for older adults, and is accurate at the time of publishing.

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How vaccines work & why they're important

How do vaccines work?

You are given a small amount of a harmless form of a bacteria or virus...

...Then your body makes an immune response, including antibodies to fight it off

Then if the real disease attacks...

...your body already has the antibodies, so you don't get sick. You are immune.

What is vaccination?

Vaccination is the safest way to protect against an infectious disease. Once you have been vaccinated, you will be able to fight the disease 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, precisely matching 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.

However, sometimes the immune system doesn't always win this initial battle against the pathogen, and you can become very ill with serious complications or in extreme cases die.

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

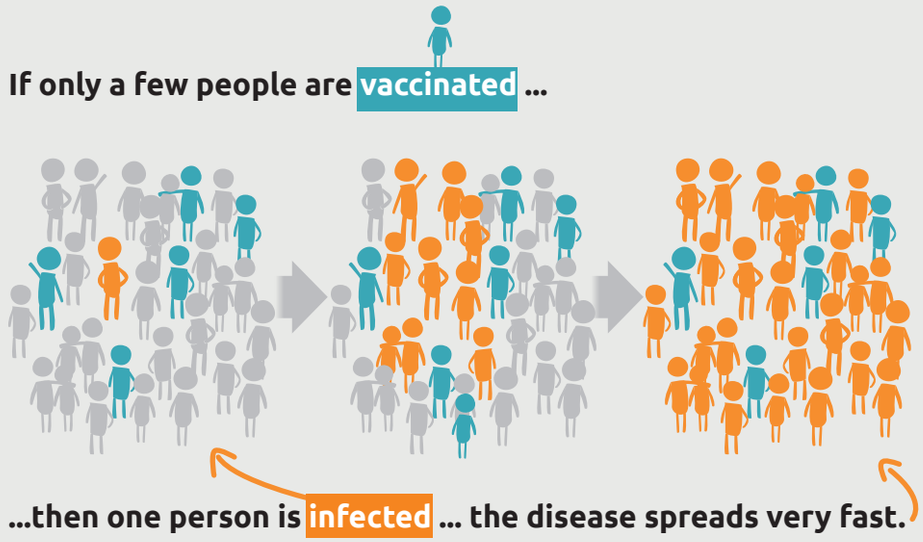
How does vaccination work?

Vaccination is the safest way to gain immunity against a bacteria or virus 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 get the disease naturally?

No. The only way to get the disease naturally would be through infection with the bacteria or virus that causes the disease. This could pose a serious risk to your health, potentially making you very ill and causing long-term health effects. Vaccination allows you to build up immunity in a safe and controlled way without becoming ill with the disease and passing the virus or bacteria to others.

What is 'herd immunity'?



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. This type of protection is known as '**herd immunity**'. Herd immunity is particularly crucial for some individuals who are unable to receive some vaccines, such as those who are too young, undergoing certain medical treatment (such as for cancer) or have a health condition that impairs the function of their immune system (such as HIV).

For herd immunity to work, a high percentage of the community needs to be vaccinated. We know that decreases in vaccination uptake can result in outbreaks of diseases such as measles.[1] If the vaccination rates in your community are not high enough, it will leave the most vulnerable at a much greater risk of catching the disease. By vaccinating, you're not only protecting yourself, but you are also protecting the most vulnerable in your community.

Why do I need vaccines as I get older?

The immune system changes throughout life and as people age, the immune system doesn't work as well as when they were younger. The white blood cells, which are our specialised immune cells, become less efficient at responding to new invading pathogens and are slower to react and protect from infection. Additionally, antibodies that are produced are less able to bind to the specific antigen. These changes in our immune system mean that we get more serious infections as we age. It's also harder to recover from infections, meaning older people experience worse illness for longer. For example, older people are more at risk of serious complications, hospitalisation and death from flu compared with younger adults. This means that vaccination plays a key role in helping to protect those with higher risk of infection in later life.

How do I know vaccines are safe?

Before a 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). Once licensed, the vaccine must then be further approved by the MHRA before it is added to the routine vaccination programme.

Even once a vaccine becomes part of the vaccination programme, it is continuously 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. You can find the yellow card scheme website at the end of this booklet.

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 and vaccines 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.[2]

> **Immunisation is a proven tool for controlling and eliminating life-threatening infectious diseases and is estimated to avert between 2 and 3 million deaths each year.**
>
> *World Health Organization*

What are vaccines made of?

Each vaccine will be made up of slightly different ingredients depending on how the vaccine has been developed and the disease it is targeting. 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.

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.

Many 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 and are particularly useful in vaccines given to older people to help counteract the age-related decline in immunity in those over 65.

Squalene, which is a type of oil, has been used as an adjuvant in the inactivated influenza vaccine given to those aged over 65 in the UK since 2018. It helps the immune system produce more antibodies against the influenza virus strains in the vaccine.[3] The influenza vaccine contains

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.

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.

less than 10mg of squalene and no severe side effects have been associated with the vaccine, suggesting that squalene oil poses no significant risk to health. [4]

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. Helpful information can also be found on the University of Oxford's Vaccine Knowledge Project webpages, which can be found at the end of this booklet.

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Routine vaccination schedule recommended by the NHS

Which vaccines do I need?

When?	What?
65 YEARS OLD	**Pneumococcal polysaccharide vaccine (PPV)** *One injection*
65 YEARS OF AGE AND OLDER	**Inactivated influenza vaccine (flu jab)** *One injection annually*
70 TO 79 YEARS OLD	**Shingles vaccines** *One injection*

Please speak to your GP about your eligibility for these vaccines.

Correct as of October 2022. Please see pages 18–19 for information about COVID-19 vaccines. Always check the NHS website for the most up-to-date information and please speak to your GP about your eligibility for these vaccines.

Pneumococcal polysaccharide vaccine (PPV)

The PPV protects against infections caused by the bacterium *Streptococcus pneumoniae* that cause pneumococcal disease. Pneumococcal infections can lead to serious and potentially fatal infections of the lungs (pneumonia), in the blood (septicaemia) and of the membranes covering the brain and spinal cord (meningitis). Adults aged 65 or over are at higher risk of serious illness from pneumococcal infections.

The PPV is an inactivated vaccine, meaning it does not contain any live bacteria and cannot give you pneumococcal disease. It protects against 23 different types of pneumococcal bacteria which cause 96% of serious infections in the UK. Most healthy adults develop an immune response to a single dose of PPV by the third week after vaccination. Adults with no underlying health conditions require a single PPV at age 65. You will only require booster doses if you have a specific underlying health condition, e.g., spleen dysfunction, or serious kidney/heart conditions. In these cases, booster doses are given every five years. If you are unsure if you require PPV booster doses, please speak to your GP. The PPV is thought to be around 50% to 70% effective at preventing pneumococcal disease, but adults can have some protection against pneumococcal disease through herd immunity.[5,6]

Inactivated influenza vaccine

The inactivated influenza vaccination, also known as the flu jab, protects against infection with the influenza virus which causes the flu, a common and highly infectious disease of the respiratory tract. The symptoms of flu are a dry cough, sore throat, fever, headache, muscles pains and extreme fatigue. For most healthy people, flu can be unpleasant and usually resolves within a few days, but in some cases can lead to serious illness with long-term effects and potentially death. Flu can be more severe in people aged over 65 as they are more likely to develop complications such as pneumonia. Influenza and pneumonia are responsible for about 8% of all deaths in older people.[7]

Vaccination is the best protection against the influenza virus. In the UK, it is available every year from the autumn onwards on the NHS to help protect people at risk. The inactivated influenza vaccine does not contain any live virus and cannot give you the flu. There are different types of flu vaccines but the current recommended vaccine for older people protects against four strains of influenza and has an adjuvant added to enhance the body's immune response. It takes up to two weeks after vaccination for your body to build up immunity and for you to be protected from flu.

It's important to have a flu vaccine every year because the flu virus changes frequently over time and new strains appear. A new strain of influenza virus occurs when the virus antigens change shape. This causes the virus to behave differently and means the immune system can't recognise it as effectively. The flu vaccine is made to protect against those strains that are expected to circulate that winter. Early each year the World Health Organization (WHO) looks at the flu strains that have been circulating around the world and decides which strains to include in the upcoming vaccine. Predicting which flu strains will circulate later in the year allows time for the vaccines to be produced but means that the flu virus can change again before vaccination begins. This can lead to a flu vaccine that isn't necessarily protective against all the viral strains that are circulating. The flu vaccine does not guarantee that you will not catch the flu but those who are vaccinated are more likely to experience a milder disease if they do catch it.

The effectiveness of the flu vaccine depends on the extent to which the viral strains in the vaccine match the circulating strains, as well as the individual's immune

response and ability to produce protective antibodies. Therefore, the effectiveness of the flu vaccine varies from year to year and between different age groups. In those aged over 65, the adult flu vaccine prevented 62% of flu cases in 2018/19 and 23% of cases in 2019/20.[8,9]

This emphasises the importance of also vaccinating children, those adults who are at increased risk (such as those with asthma) and healthcare professionals for both their own protection, and to create herd immunity to help prevent the spread of flu to older adults and protect the most vulnerable.

Shingles vaccine

The shingles vaccine protects against shingles, a disease caused by reactivation of the chickenpox (varicella-zoster) virus. Only those who have had chickenpox in the past can develop shingles, usually decades after the initial infection. Initial infection with the varicella-zoster virus typically occurs during childhood and causes chickenpox but the virus then establishes a permanent hidden infection in the nerves as an inactive form. It may remain this way forever but if the virus is reactivated it can lead to the person developing shingles. Varicella-zoster virus reactivation occurs when the immune system is suppressed, such as with increasing age. The risk and severity of shingles increases with age, with about 70% of cases occurring in people aged over 70.[7]

Shingles, also known as herpes zoster, causes a painful skin rash with blisters and can lead to persistent pain at the site called post-herpetic neuralgia (PHN). Complications of shingles depend on the nerves affected and include facial muscle weakness and painful inflammation of the eye tissues. In some rare cases, mainly affecting those who have weakened immune systems, it can lead to fatal pneumonia. The shingles vaccine reduces the risk of getting shingles by 38% in adults aged over 70 and if you do experience the disease, symptoms may be milder and shorter-lived. The vaccine also prevents 66% of cases of PHN in older people.[10] The shingles vaccine works well in people who have had shingles before and reduces the risk of further shingles attacks. The latest data show that the vaccine is effective for up to five years.

The shingles vaccine contains live, attenuated (weakened) varicella-zoster virus. There has been no evidence of a vaccinated individual passing the virus on to others, but theoretically this may be possible in rare cases.

> ***Your immune system protects you from disease throughout your life, but as you get older it needs an extra helping hand. Vaccination gives your body the boost it needs to prevent you getting seriously ill from vaccine preventable diseases.***
>
> *Dr Emma Chambers, BSI vaccine champion*

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Vaccinations for COVID-19 in adults over 65

Why do older adults need the vaccine against COVID-19?

Everyone over the age of 65 is recommended the vaccine for COVID-19. The vaccine reduces the risk of developing serious disease and death from infection with the SARS-CoV-2 virus, which causes COVID-19. The biggest risk of death from COVID-19 comes with age and each older generation has approximately 10 times the risk of dying from COVID-19 than the generation below it. The vaccine has been shown to be effective in preventing disease in older people. Since the introduction of the COVID-19 vaccination programme death as a result of COVID-19 infection has decreased significantly.[11]

Which COVID-19 vaccine is offered to adults over 65?

The Joint Committee on Vaccination and Immunisation (JCVI) prioritise older people for the primary course of two vaccinations and subsequent booster doses, as the risk of severe disease is higher.

There are currently four different COVID-19 vaccines approved and in use in the UK which are recommended for adults over 65. The Pfizer/BioNTech, Moderna, Oxford/AstraZeneca and Novavax (only when no other clinically suitable alternative is available). It is safe to have any of these vaccines as your booster, irrespective of the vaccines you have had previously. Any combination of vaccines provides protection from severe disease resulting from COVID-19.

Further information about COVID-19 vaccines can be found in the BSI's guide to vaccinations for COVID-19 on the BSI website listed at the end of this booklet.

Can I get a flu vaccine and a COVID-19 booster at the same time?

It's safe to recieve a Pfizer/BioNTech or Moderna COVID-19 booster and flu vaccine at the same time, without impacting the effectiveness of either vaccine. However, if you receive a Novavax COVID-19 booster you should receive your flu vaccination at least seven days later, this is to ensure you produce a strong immune response to both vaccines.

> ***At the British Society for Immunology, we understand that you may have specific questions about the COVID-19 vaccines and we aim to provide evidence-based information and address concerns so everyone can make an informed decision about vaccination.***
>
> *Erika Aquino, BSI Public Engagement Manager*

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Common questions about vaccines

Concerns over vaccine safety have allowed unsupported information about vaccination to spread and the large amount of unverified information available on the internet about vaccination can make it difficult to distinguish facts from fiction. Here are answers to some of the most common questions about vaccines.

Is there a situation when I shouldn't be vaccinated?

It is very rare that someone is unable to be vaccinated. Only people with a weakened immune system, caused by a medical treatment such as chemotherapy, an allergy to the vaccine or its components, or certain medical conditions affecting the function of their immune systems may be unable to receive all the vaccines recommended in the immunisation schedule. People with allergies to any vaccine ingredients should not receive it. Please speak to your GP if you are concerned about whether you're able to receive all the vaccines in the immunisation schedule.

Why do some people still get the disease even after they have been vaccinated?

Vaccines are the most effective medical intervention we have for preventing disease. However, no medicine can ever be 100% effective and the effectiveness of the vaccine will differ depending on how it is made and the disease it is protecting you from.[14] As mentioned previously, the effectiveness of the flu vaccine depends on the viral strains in the vaccine matching the circulating strains, leading to the effectiveness changing from year to year.

Variations in individual immune systems mean that the protective capacity of the 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 people. If a high enough proportion of people are immunised, those who have not developed immunity from the vaccine will be protected by herd immunity.[15]

Your immune system needs time to respond to the vaccine and immunity may take up to three weeks to develop after vaccination. In this time, it is still possible for you to catch the disease and become ill as the vaccine has not yet had time to take effect.

Can I catch flu from the flu vaccine?

The inactivated influenza vaccine does not contain any active virus and therefore cannot give you flu illness. If you have what you think is flu after vaccination it may be that you caught flu before the vaccination had taken effect as it can take two weeks for your body to develop immunity. Alternatively, you may have caught another virus that is not influenza but has given you flu-like symptoms.[17] You may get a mild fever and slight muscle aches for one or two days after the flu vaccine, however this is not the flu illness itself but rather a side effect of the vaccine as your immune system responds to it.

Are animal products used in vaccines?

Some live vaccines, such as the shingles vaccine, contain gelatine, which is derived from pigs. This is used to stabilise the vaccine so that it can be stored safely at different temperatures. The gelatine used is highly purified and broken down into very small molecules so that no pig DNA remains. Members of some faiths may however be concerned about using vaccines containing pig-derived gelatine. According to Jewish laws, porcine products in non-oral products, including vaccines, cause no concern.[16] Similarly, many Muslim leaders have ruled that the presence of gelatine in vaccines does not break religious

dietary laws due to its high purification and non-oral administration.[16]

The virus used in the inactivated flu vaccine is grown in fertilised chicken eggs, therefore the vaccine may contain traces of the egg protein ovalbumin. Although the ovalbumin content is very low in the vaccine, it is not recommended for those aged over 65 with an egg allergy.[3] An egg-free alternative vaccine can be given to these individuals.

The current COVID-19 vaccines approved for use in the UK do not contain animal products.

Can receiving multiple vaccinations overload the immune system?

No. Your immune system fights off millions of germs every day. The number of bacteria or virus in a vaccine is very small in comparison and will put no extra strain on your immune system. Even if you receive several different vaccines at once, they would still only be using less than a thousandth of your immune system's capacity.[18] It is safe to receive the PPV, shingles and influenza vaccines at the same time. It is also safe to recieve the influenza and Pfizer/BioNTech or Moderna COVID-19 vaccines at the same time. However, if you receive a Novavax COVID-19 vaccine, it must be at least seven days apart from your influenza vaccination. This is to ensure maximum efficacy of both vaccines. It is recommended to leave seven days between the shingles vaccine and a COVID-19 vaccine, so that if you have any side effects, you'll know which vaccine they were from.[19]

I'm never ill, why do I need a vaccine?

Even if you believe that you're not at risk of falling ill from an infectious disease, it's important to remember how easily they can spread and their potential fatality. Vaccines decrease your chance of catching these diseases and reduce how unwell you become if infected. Importantly, vaccination not only protects you, but it also protects the most vulnerable in your community. By getting vaccinated you're contributing to herd immunity, which is crucial for some individuals who are unable to receive some vaccines, such as those undergoing certain medical treatment (such as for cancer) or those with a health condition that impairs the function of their immune system (such as HIV).

Is there mercury in vaccines?

No vaccines used in UK routine vaccinations contain mercury.

Extensive research shows that there is no link between the levels of mercury, also referred to as thiomersal, used in vaccines and conditions such as brain damage and autism in children. Nevertheless, in an effort to reduce global environmental exposure to mercury, US and EU regulators have phased out thiomersal use in vaccines.[20, 21]

Do vaccines cause allergies and autoimmune diseases?

The occurrence of autoimmune diseases, such as rheumatoid arthritis, and allergies has increased over the last few decades and it is still unclear why this is happening. Vaccination rates have also increased during this time, which has led some people to believe that vaccines could be the cause. However, many large-scale studies have not found any evidence that vaccination triggers allergies or causes autoimmune disease.[22, 23] The rise in allergies and autoimmune diseases has been more closely linked to lifestyle and environmental changes.

Additional resources

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

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

BSI – A guide to vaccinations for COVID-19
https://www.immunology.org/guide-covid19-vaccines

NHS website – vaccinations and when to have them
http://bit.ly/NHSvacc

NHS website – why vaccination is safe and important
http://bit.ly/NHSsafe

Vaccine Knowledge Project (University of Oxford)
http://vk.ovg.ox.ac.uk

UKHSA Immunisation against infectious disease Green Book
https://bit.ly/3D6cSOT

British Geriatrics Society – vaccination programmes in older people
https://bit.ly/3s1iiV9

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

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

This guide has been produced by the British Society for Immunology in collaboration with the CARINA Network and is sponsored by the UK SPINE Knowledge Exchange network.

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 support over 4,000 members who study the immune system and vaccines.

The CARINA Network is a collaborative network for researchers working on the immune system throughout the life course. The CARINA Network is funded by the Medical Research Council and the Biotechnology and Biological Sciences Research Council through the collaborative 'Healthy Ageing Across the Life Course' initiative. To find out more, visit www.immunology.org/carina

The UK SPINE Knowledge Exchange network aims to improve healthspan (healthy life-years) for patients with multiple age-related conditions by accelerating the discovery, development and testing of new drugs, better understanding the underlying biology which drives these conditions, and working with patients and the public to consider the regulatory needs for such treatment. For further information, visit www.kespine.org.uk

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