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Overview of childhood vaccines, immunity and disease

These slides provide an overview of the NHS childhood vaccination schedule, why vaccines are given to children, why they are safe and how they work.

A training session based on this content can be delivered to your team by one of the North Central London NHS Immunisation Improvement Project Managers. To arrange a session or find out more, please contact:

- **Emma Raworth**, **Immunisation Improvement Project Manager for Camden**
- **Daniel Subel, Immunisation Improvement Project Manger for Haringey and Islington**

February 2024

Why do we vaccinate children?

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Vaccines protect against serious diseases, including:

- **Meningitis**
- **Polio**
- **Diphtheria**
- **Measles**
- **Tetanus**
- **Whooping cough**
- **Rubella**
- **Hib**
- **Pneumonia**
- **Mumps**
- **Rotavirus**
- **Hepatitis B**

Many of these diseases are life threatening or life changing. Some, like polio, have no cure. These diseases used to kill many babies and children before vaccines were created to protect against them.

Before vaccines

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Before a vaccine was introduced in 1942, diphtheria killed an average of 3,500 children a year in the UK.

Polio epidemics in the UK resulted in up to 7760 cases of paralytic polio each year, with up to 750 deaths. Polio was the most feared disease in the world.

Source: https://vk.ovg.ox.ac.uk/vk/

© WHO / Paul Palmer
Before the first poliovirus vaccine in 1955, children affected by polio depended on an iron lung for their survival.

When vaccines are given

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Age	Vaccine
8 weeks (2 months)	**6-in-1 vaccine** *single jab protects against diphtheria, hepatitis B, Hib, polio, tetanus & whooping cough* **MenB vaccine** *protects against a bacteria which can cause meningitis and sepsis (blood poisoning)* **Rotavirus vaccine** *1st dose*
12 weeks (3 months)	**6-in-1 vaccine** *2nd dose* **Rotavirus vaccine** *2nd dose* **Pneumococcal vaccine** *protects against pneumonia, meningitis and sepsis*
16 weeks (4 months)	**6-in-1 vaccine** *3rd dose* **MenB vaccine** *2nd dose*
1 year	**Hib/MenC vaccine** *protects against meningitis, pneumonia and sepsis* **MMR vaccine** *protects against measles, mumps and rubella* **Pneumococcal vaccine** *2nd dose* **MenB vaccine** *3rd dose*
From 2 years	**Children's flu vaccine** *yearly nasal spray (Children at high risk can get a flu vaccine from 6 months)*
3 years & 4 months	**MMR vaccine** *2nd dose* **4-in-1 pre-school booster** *single jab protects against diphtheria, tetanus, whooping cough and polio*

Missed Vaccinations

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- The 14 routine childhood immunisations are free
- The routine childhood immunisations should be given at the age on the schedule to best protect the child. However, if a child or adult has missed one or all of their vaccines they can receive the vaccines at any age and they will still be free
- Some vaccines like the Rotavirus and MenB can only be given to children under the age of 2 years
- If a child has been vaccinated in another country, they may need to be re-vaccinated in the UK. If they are new to the UK, they need to contact their GP practice. The practice nurse will go through all the immunisations they have already had and work out what vaccinations they can safely be given. These vaccines are free.

Link between Vaccine Uptake and Level of Deprivation

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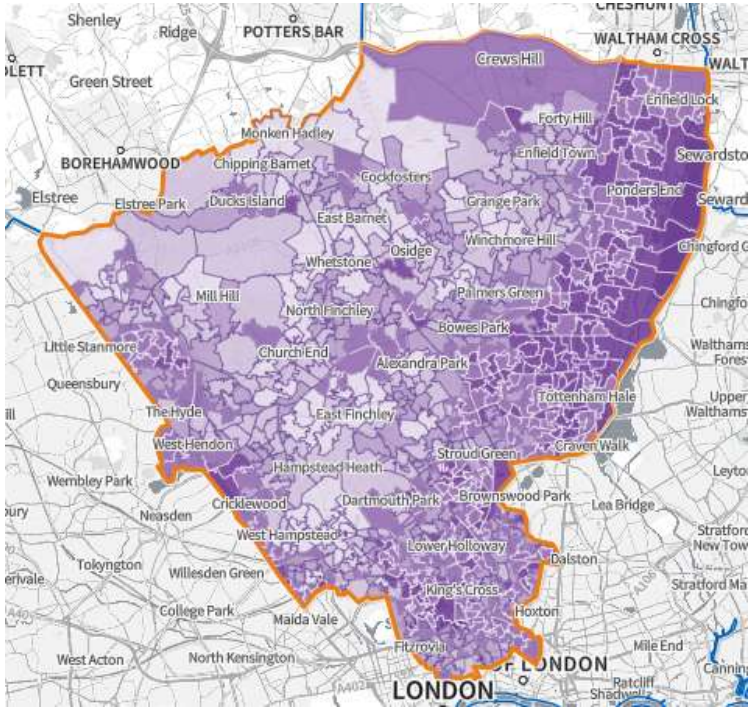
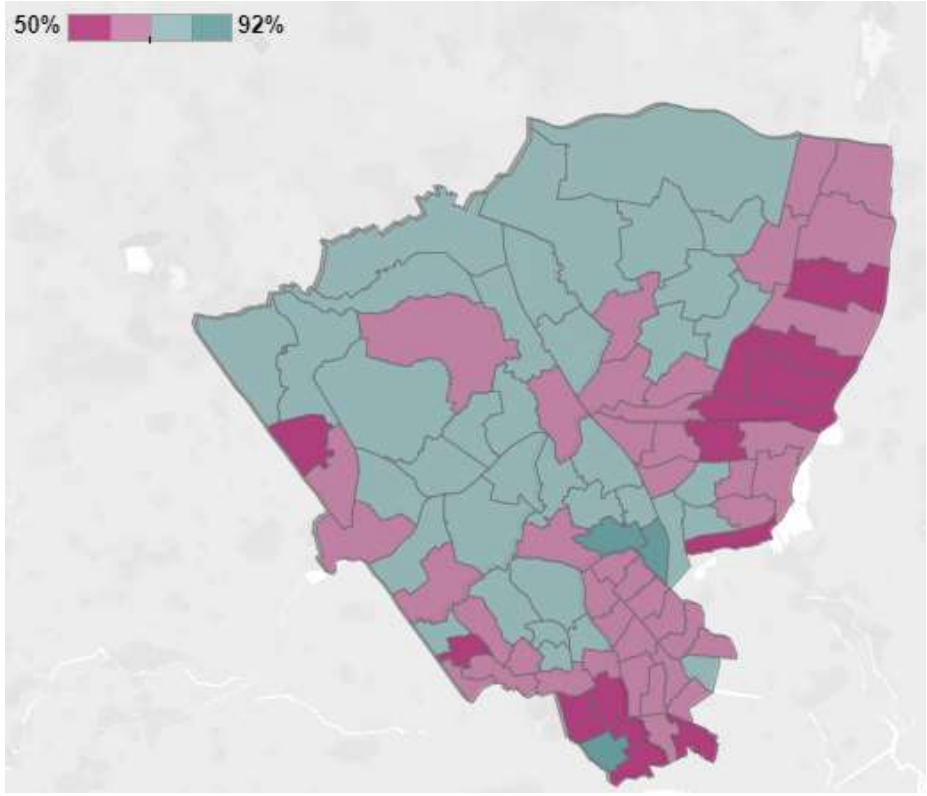
The map below shows the indices of deprivation across NCL. The darker the colour the higher the level of deprivation.



The map below shows the uptake of all routine childhood immunisations by the age of 5 across NCL.



NCL has areas with high levels of deprivation.

As can be seen by comparing these two maps, there is a correlation between childhood vaccine uptake and levels of deprivation.

We need your help

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The low uptake of vaccination in NCL leaves many children with no protection from potential disease outbreaks.

Measles is a particular concern. Measles is one of the most infectious diseases and can cause serious complications.

The MMR vaccine provides very good protection against measles. The first dose is given at 12-13 months, because it does not work so well in children under 1 year of age. This leaves babies under 1 and unvaccinated children at high risk if there is a measles outbreak.

Please talk to parents and carers about vaccines

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The risk of unvaccinated children catching serious diseases is very real.

The following slides give more information about vaccines, immunity and disease.

Please share this information with parents and carers to help protect children and babies.

The presentation ends with some tips on how to approach the topic with parents. Thank you for your support.

History of vaccines

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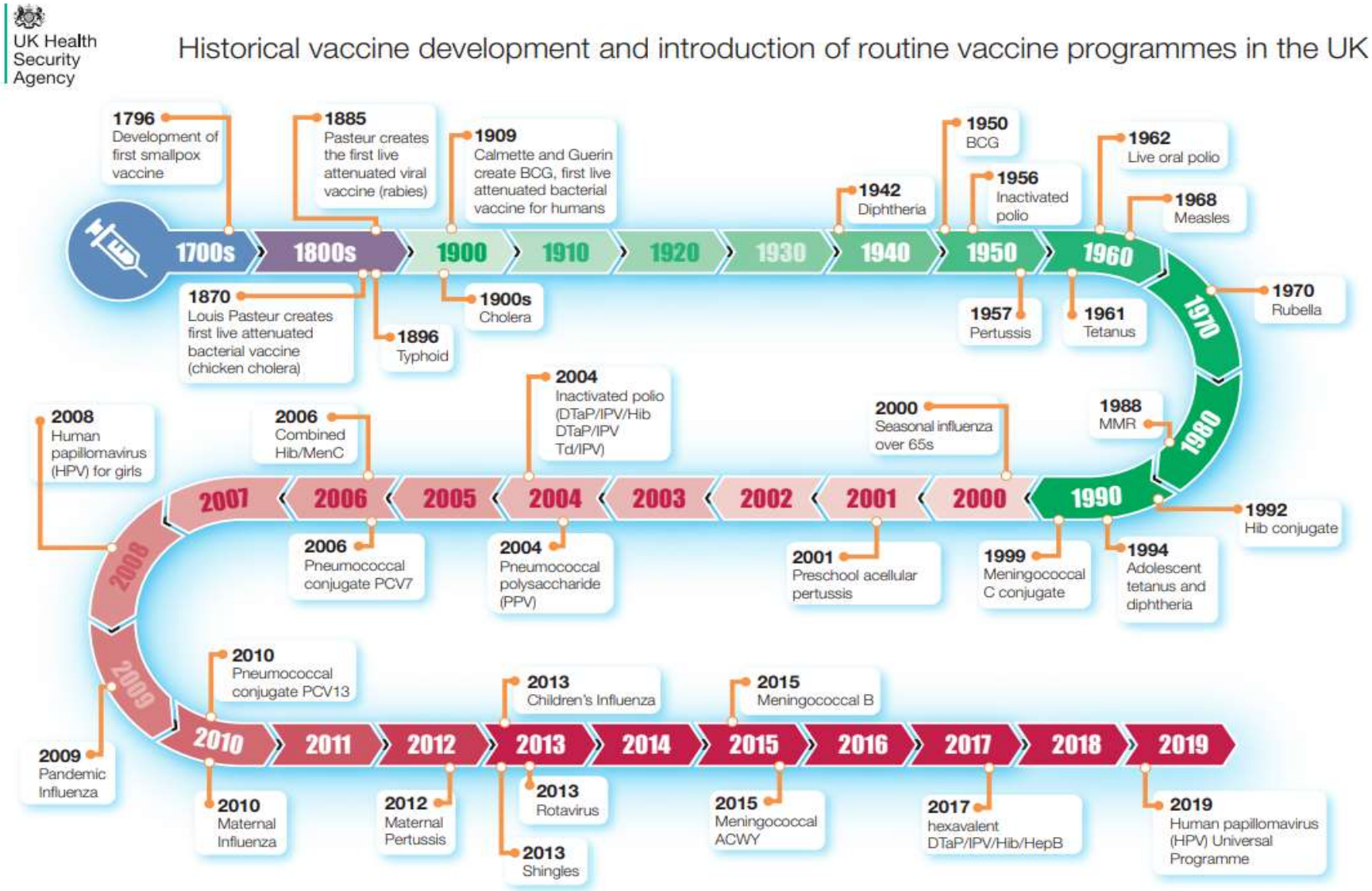
Vaccines have been used safely for many years.

The first vaccine was developed over 200 years ago.



The impact of vaccines

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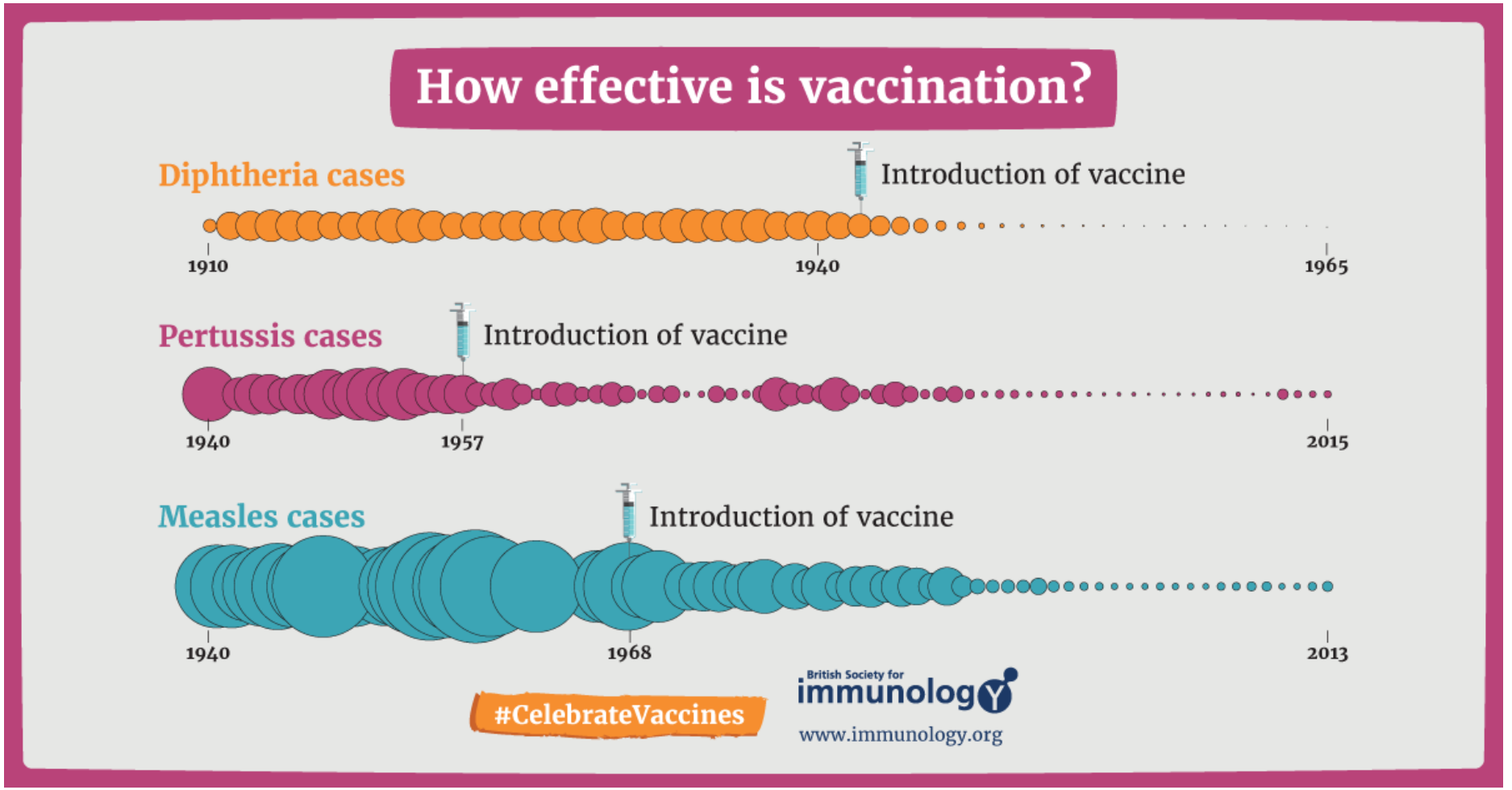

These diseases have not disappeared

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While immunisation is very effective at reducing disease, the diseases we immunise against in the UK all still exist in the world today.

There have been over 2,500 cases of measles and over 11,000 cases of mumps in the last 7 years in England alone.

Year	Measles	Mumps	Rubella
2016	526	537	2
2017	265	1,796	3
2018	968	1,061	3
2019	797	5,055	3
2020	79	3,215	0

Confirmed cases of measles, mumps and rubella in England, 2016 to 2020.

Source: https://www.gov.uk/government/publications/measles-confirmed-cases/confirmed-cases-of-measles-mumps-and-rubella-in-england-and-wales-2012-to-2013

Vaccination rates and disease spread

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Around 95% of children need to be vaccinated to prevent the spread of avoidable serious diseases such as measles and polio.

Only 66% of children aged five in North Central London have had both doses of the MMR vaccine, leaving many children and babies vulnerable to infection from measles, mumps and rubella.

Low vaccination rates leave children vulnerable to diseases which can have dangerous complications.

Baby Alba suffering from measles at Chelsea and Westminster Hospital in 2019. Photo shared by the baby's mother Jilly Moss to raise awareness of the importance of vaccination.

Measles is highly infectious

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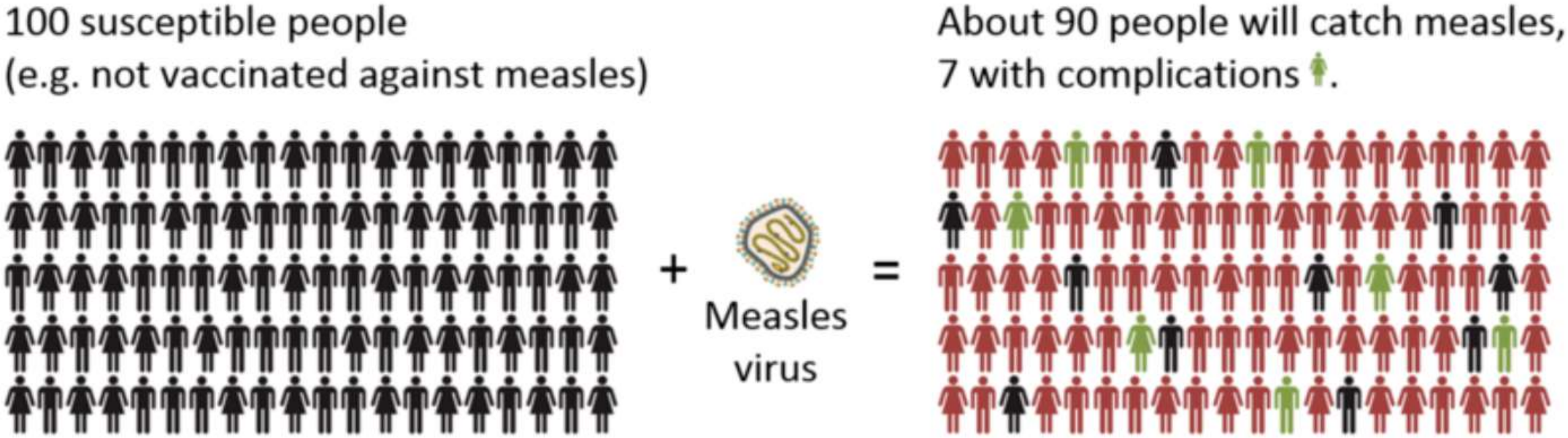

In a group of 100 susceptible people (e.g. not vaccinated against measles) up to 90 susceptible individuals would catch the virus and up to 7 would develop complications.

Herd immunity

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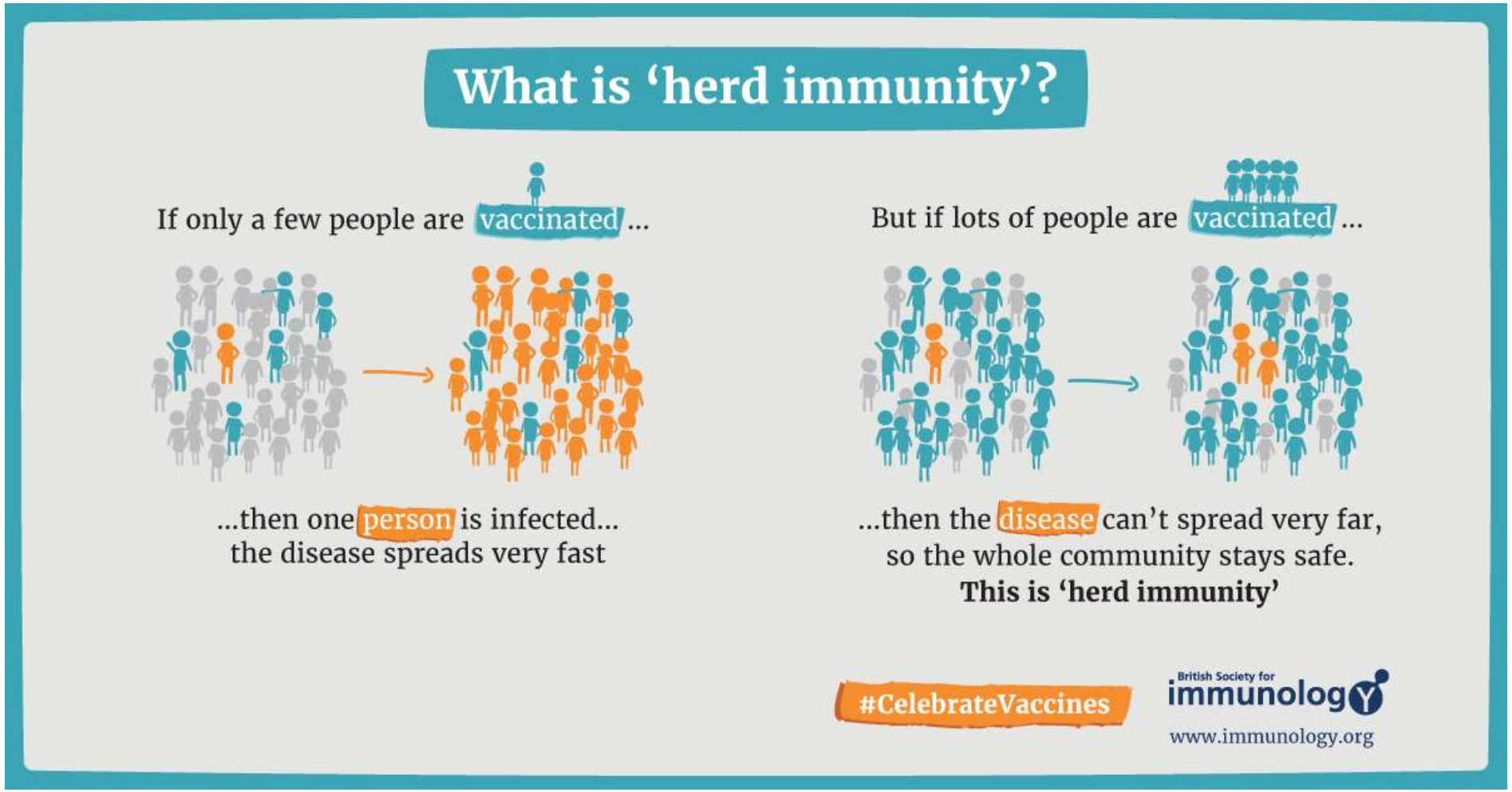

Number and timing of vaccine doses is critical

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The vaccines are all timed for ages when:

- children become vulnerable to each disease, and
- they are able to develop a long-lasting immune memory of the diseases and get the best protection possible.

Only the complete set of doses gives long term protection.

Delaying between doses leaves children in danger of becoming infected.

What parents need to do

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Make an appointment with their GP surgery for their child to get each vaccine at the right time.

GPs should remind parents by letter and text when vaccines are due. But if they don't hear anything, parents should still contact their GP to make an appointment.

Bring the child's red book to every appointment so vaccinations can be recorded.

If any vaccination appointments were missed, it is never too late to catch up – vaccines protect for life and adults can have them too. Anyone unsure if they may have missed having some vaccines as a child can make an appointment with their GP to catch up.

What happens at the appointment?

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Vaccines are usually given by the practice nurse.

Appointments take around 10-15 minutes.

The nurse will explain the process, any potential side effects and what to do if they occur.

Parents can ask as many questions as they want. Parents then decide if they want the vaccination to go ahead.

The nurse will carry out several checks before giving the vaccine to make sure that everything is correct.

Babies can be breastfed or given a dummy during vaccination.

(Recommended by the Association of Paediatric Anaesthetists of Great Britain and Ireland)

The nurse will record the vaccination in the child's red book.

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More about immunity and vaccines

How do vaccines work?

How are vaccines developed?

What is in a vaccine?

Are vaccines safe?

Our immune system

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Bacteria and viruses are all around us.

Our immune system is always working to protect us.

Vaccines teach our immune system how to recognise and attack a bacteria or virus before it can make us sick.

Illustrator Maxim Usik

How do vaccines work? Overview

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Video created by the British Society for Immunology

Watch here: https://www.youtube.com/watch?v=z3ZacsU4lQs

How do vaccines work?
More detail

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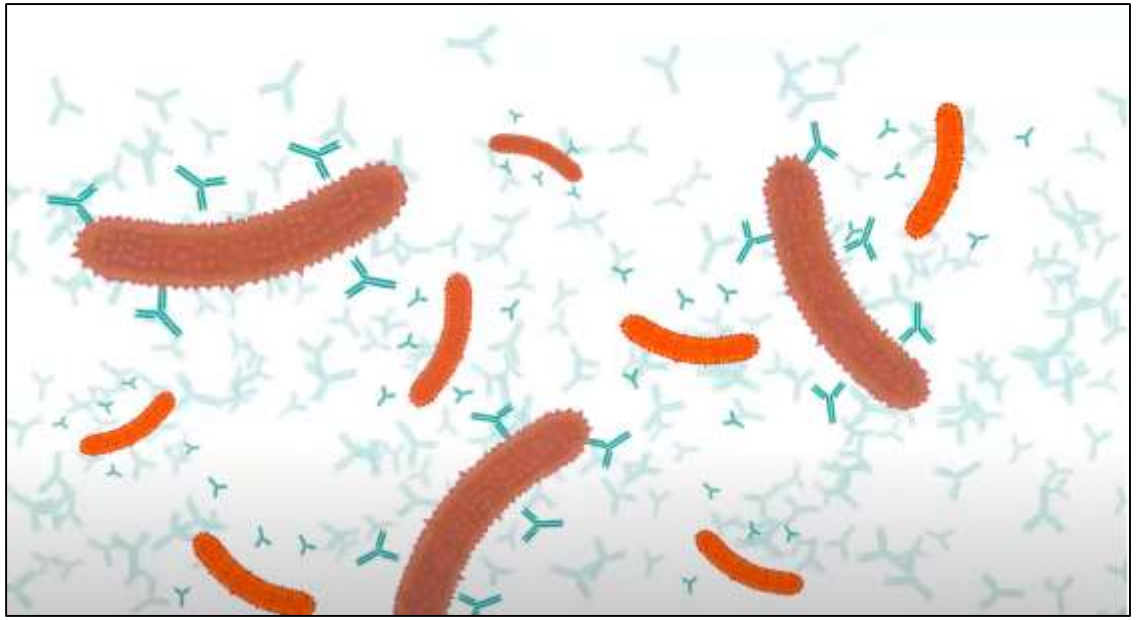

Video created by the Oxford Vaccine Group

Watch here: https://www.youtube.com/watch?v=-muIoWofsCE&t=11s

How are vaccines developed?

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A vaccine first goes through many laboratory tests.

Clinical trials are then carried out on thousands of volunteers who are closely monitored to make sure it's safe and effective.

A vaccine then has to go through further rounds of approvals before being added to the routine immunisation programme.

What's in a vaccine?

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Vaccines use only the ingredients they need to be as safe and effective as possible.
Every vaccine ingredient serves its purpose:

- To provide immunity
- To keep the vaccine safe and long lasting
- To make the vaccine more effective

These are some of the ingredients most commonly found in vaccines. This is not a complete list. For the full list of ingredients for a specific vaccine, see the patient information leaflet provided by the manufacturer.

The main ingredient in vaccines is water.

10 drops is how much water is in a typical vaccine

Ingredient	Purpose	Found in larger quantities in	DID YOU KNOW?
Aluminium/ Aluminium salts	Boosts the body's response to the vaccine.	Breast milk; Formula milk; Glass of water	Aluminium is found naturally in many foods and drinks. Our kidneys filter it out and remove it in our urine.
Formaldehyde	Used very early in the manufacturing process to kill or inactivate the toxins from bacteria or viruses. Only a tiny amount remains in the finished vaccine.	Pear; Banana; Fish	Formaldehyde is found naturally in our bloodstream. It is made and used by the body to create energy.
Neomycin	Used to stop bacteria growing as vaccines are made.	Medicine	Neomycin is an antibiotic used to treat some kinds of infections.

What's in a vaccine?

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Ingredient	Purpose	Found in larger quantities in	DID YOU KNOW?
Sorbitol	Keeps the vaccine stable and allows it to be moved and stored without changing.	Pear, Plum, Cherries	Sorbitol is a sugar naturally made in the body and found in fruits and berries.
Medium 199, a solution which contains amino acids, mineral salts and vitamins. These are some of the ingredients of Medium 199.			
Adenine – Vitamin B4	Keeps the vaccine stable and allows it to be moved and stored without changing.	Whole Grain, Leafy Greens, Strawberries	Adenine helps the body produce energy.
Adenosine		Oily Fish, Nuts, Eggs	Adenosine helps with sleep and blood circulation.
Folic acid		Egg, Leafy Greens, Pulses	Folic acid helps the body make healthy red blood cells.
Phenylalanine		Beans, Egg, Meat	Phenylalanine is essential to normal growth and development.
Potassium		Banana, Potato, Broccoli	Potassium works with sodium to help balance fluid levels and blood pressure.
Sodium/ Sodium Chloride		Baked beans, Cheese, Ketchup	Sodium works with potassium to help balance fluid levels and blood pressure.
Thymine – Vitamin B1		Cauliflower, Nuts, Whole Grain	Thymine helps us turn food into energy. It is important for the heart and brain which need lots of energy.

Vaccine ingredients

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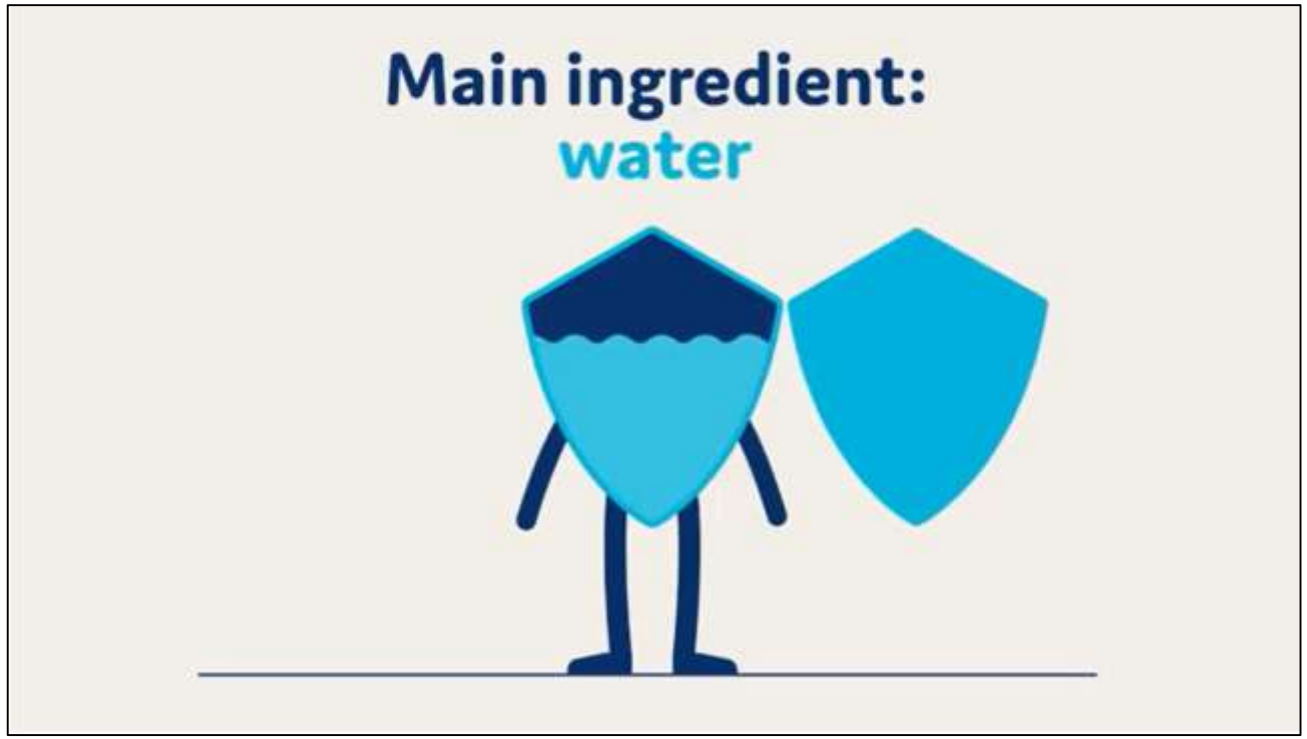

Video created by the British Society for Immunology

Watch here: https://www.youtube.com/watch?v=z3ZacsU4lQs

Continuing vigilance

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Scientists and researchers are continuously analysing the effectiveness and safety of vaccines.

All vaccines can cause side effects, but most are mild and short lived.

Before giving a vaccine, clinicians explain potential reactions/side effects and advise on what to do if they happen.

General side effects are a sign that the body's immune system is doing its job. They include:

- Slightly raised temperature
- General aches
- Tiredness
- Swelling at the injection site

Find out more at www.nhs.uk/vaccinations

Talking to parents about vaccines

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Suggested approach:	
Act as a guide not a persuader	*“Has your surgery contacted you about booking an appointment for _____ to have their jabs?”*
Listen	*“Has anyone talked to you about immunisations for _____?”*
Acknowledge and empathise with concerns or worries	*“How did it go at the doctors the other day for baby’s immunisations?”*
Share reliable sources of information	*“Has your GP been in touch about _____’s MMR jab?”*

More suggested talking points

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- Is your child up to date with their vaccinations?
- Lots of children missed getting vaccinations over the past couple of years, putting them at risk of preventable diseases.
- Look in your child's red book or contact your GP to check.
- If your child has missed any of their vaccines, it's not too late to catch up - make an appointment with your GP as soon as you can.
- The MMR vaccine is safest way to protect your child from measles, mumps and rubella, which are very infectious and can cause serious illness including meningitis and pneumonia.
- Your child needs two doses of the MMR vaccine – one dose at one year old, and one dose at three years and four months old.

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Resources and more information

Where can parents find information and support?

Parents can make an appointment to talk to their practice nurse, GP or health visitor if they have any questions about their baby's immunisations. Healthcare professionals will be happy to discuss any concerns parents may have and to provide more information.

Some trusted sources of information

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NHS nhs.uk/vaccinations
NHS North Central London nclhealthandcare.org.uk/vaccinations
NHS Healthier Together: Measles what0-18.nhs.uk/parentscarers/worried-your-child-unwell/measles-new
NHS Start 4 Life nhs.uk/start4life/baby
UK Health Security Agency gov.uk/UKHSA
British Society for Immunology immunology.org/public-information
Oxford Vaccine Group Vaccine Knowledge Project vk.ovg.ox.ac.uk/vk/
World Health Organisation who.int/health-topics/vaccines-and-immunization
UKHSA news gov.uk/government/news/parents-warned-about-dangers-of-children-missing-vaccines
UKHSA blog ukhsa.blog.gov.uk/2022/10/25/5-ways-to-protect-your-under-5s-this-winter/