

# Vaccinations & Herd Immunity

## Vaccination Programmes

Provides immunity against infectious diseases.

## Vaccine ingredients

### 1. Antigens from infectious pathogen

Creates **memory cells** from exposure to pathogen's foreign antigens without disease symptoms

#### Forms

1. Inactivated pathogen toxins
2. Dead pathogens
3. Part of pathogens
4. Weakened pathogens

### 2. Adjuvant

This enhances the immune response (vaccine more effective)

## Herd Immunity

Occurs when a large percentage of the population is immunised .

## Advantage of Herd Immunity

**Non-immune individuals are protected** as there is a **lower probability** they will come into contact with infected individuals and less disease spread.

## Herd immunity threshold

Percentage of the population that must be vaccinated in order for herd immunity to be achieved.

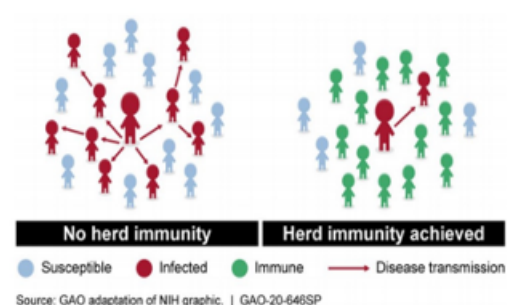
1. Type of disease
2. Effectiveness of vaccine
3. Population density

## Mass vaccination programmes

Ensure herd immunity.

## Problems with widespread vaccination

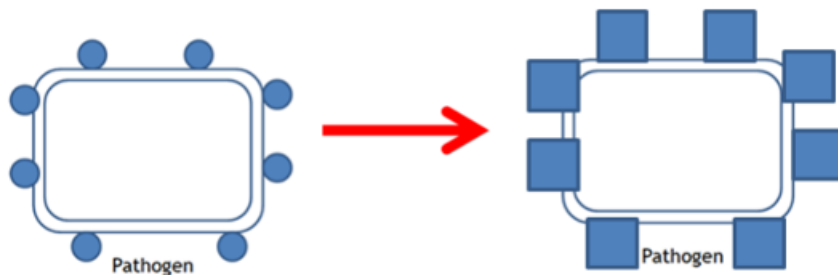
1. Poverty
2. Vaccine rejection



# Antigenic Variation

## Antigenic Variation

Pathogens can change their foreign antigens meaning that **memory cells are not effective** against them.



## Flu Virus

The flu virus poses a **major public health risk** as it shows **high antigenic variation**

At risk individuals must be **vaccinated each year** to protect them from the ever changing virus.

# Clinical Trials

Studies to test the **safety** and **effectiveness** of vaccines/drugs **before** they are **licensed** for use.

## Features of Clinical Trials

### 1. Randomised

Subjects are split into groups up in a **random way**.

This **reduces bias in distribution of characteristics** that cannot be made to be the same e.g. age/gender

### 2. Double blind

Neither the subjects nor the researchers know if they are receiving drug/placebo,

This **reduce bias interpretation** of results

### 3. Placebo controlled

One group will receive the placebo drug/vaccine which is the exact same form but lacks the active ingredient.

This allows a valid comparison and proves the drug/vaccine causes the improvement in results

### 4. Large sample size

A large sample (100+ people)

This reduce the magnitude of experimental error & increase the reliability of the results.

## Statistical Significance & Error Bars

### Error bars

Show the **range of variation** of results around the mean value.

The **larger the range**, the **less reliable** the results.

Example:  $20 \pm 10\text{mm}$

Mean results was 20mm

Range of values was 10-30mm

Less reliable results as bigger range

Example  $20 \pm 5\text{ mm}$

Mean value was 20mm

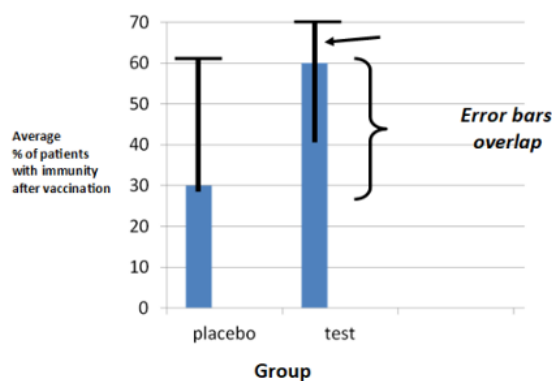
Range of values was 15-25mm

More reliable results as smaller range

### Statistical Significance

For statistically significant results the error bars DO NOT overlap between the placebo & treatment.

#### Not statistically significant



#### Statistically significant

