Different types of Covid Vaccines: efficacy and side effects

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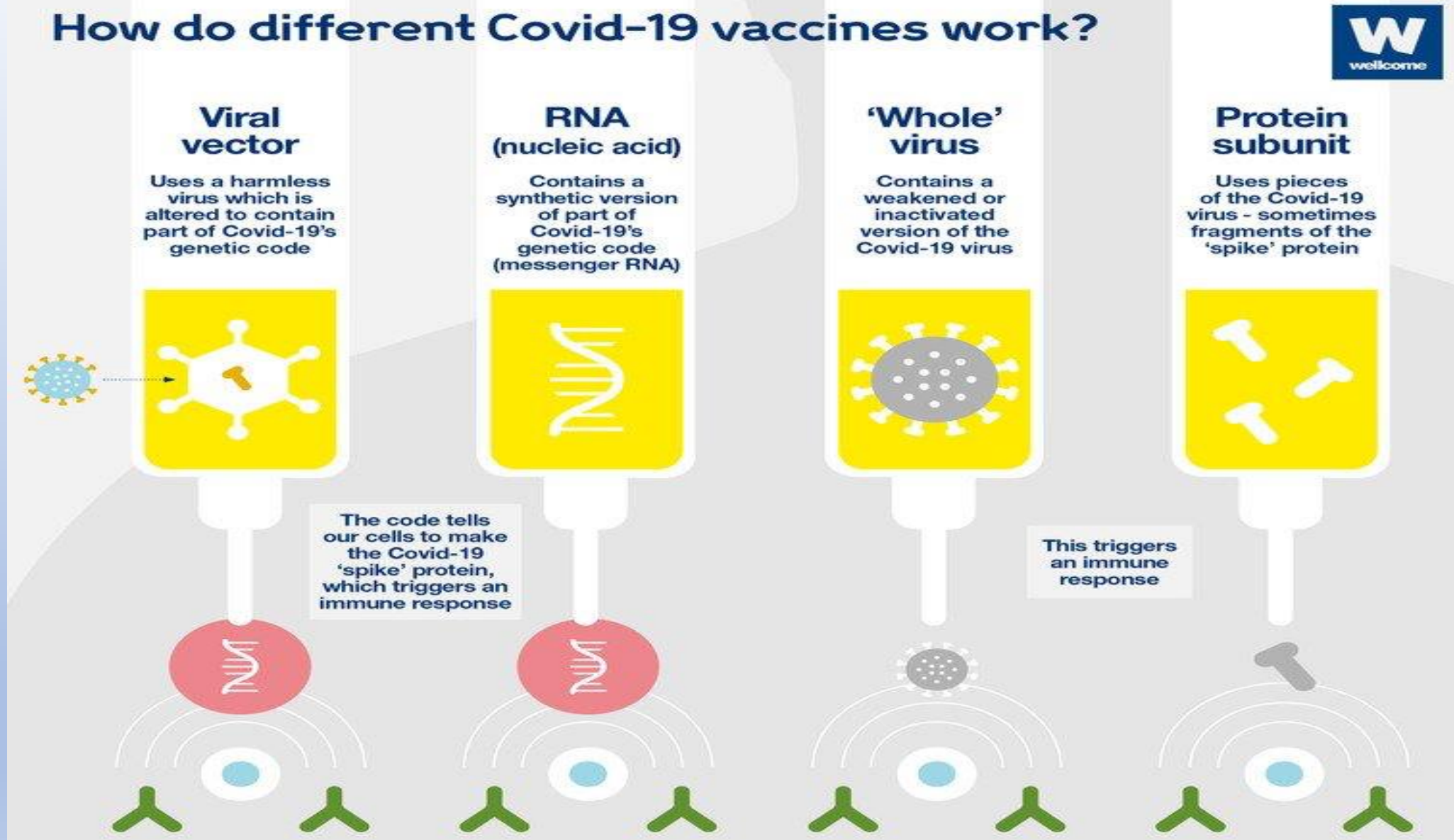
How do different Covid-19 vaccines work?



Source: Gavi https://www.gavi.org/vaccineswork/there-are-four-types-covid-19-vaccines-heres-how-they-work

Viral vector vaccines

- A harmless virus is altered by introducing part of the disease-causing virus' genetic code, such as the code for Covid-19's 'spike' protein.
- The harmless virus transports the code into our cells – in a similar way to RNA vaccines – which then start to produce the protein.
- This triggers an immune response, priming our immune system to attack the real virus later.

Viral vector vaccines

- Oxford-AstraZeneca is the first viral vector vaccine to be approved for Covid-19.
- They all use adenoviruses – a group of viruses that cause the common cold – as the vector or carrier.

RNA vaccines

- Messenger RNA is a sequence of genetic code which our bodies use all the time – it tells our cells what proteins to build so they can function.
- To produce an RNA vaccine, scientists develop a synthetic version of the virus' messenger RNA.

RNA vaccines

- When this is injected into our bodies, cells read it as an instruction to start building the relevant viral protein, for example Covid-19's 'spike' protein.
- This prompts our immune system to respond, and in doing so it learns how to protect against future Covid-19 infection.

RNA vaccines

- Two RNA Covid-19 vaccines have been approved for use: Pfizer-BioNTech and Moderna.

- Both have reported high levels of vaccine efficacy – around 95%.

Whole’ virus vaccines

- These vaccines could be:
- Inactivated – a version of the virus is inactivated by being exposed to heat, chemicals or radiation.
- Virus-like particle – a version of the virus, closely resembling the real thing, is created artificially, however it doesn’t contain any genetic material, so it’s not infectious.

Whole’ virus vaccines

- These vaccines cannot cause the disease, but will cause our bodies to produce an immune response which will protect against future infection.
- Some of the most advanced inactivated Covid-19 vaccines :
- Sinovac, Bharat Biotech and two by Sinopharm. Examples of existing inactivated vaccines include the whooping cough, rabies and hepatitis A vaccines.

Protein subunit vaccines

- A small piece of the virus' genetic code is inserted into another cell – perhaps a bacterial, yeast, mammalian or insect cell.
- The code contains instructions for this cell to start building the virus protein, for example the Covid-19 'spike' protein.
- Cells like this act as factories, building large quantities of the protein – which is then extracted, purified and used as the active ingredient in the vaccine.

Protein subunit vaccines

- When it is injected, our bodies learn to recognize the viral protein so that they can mount an immune response which protects against future infection.
- Some of the most advanced Covid-19 vaccines using this approach include Novavax.
- An example of an existing protein subunit vaccine is for hepatitis B, which uses yeast cells to build the virus protein.

Vaccine	Efficacy at preventing disease: ancestral & Alpha	Efficacy at preventing infection: ancestral & Alpha	Efficacy at preventing disease: Beta, Gamma, Delta	Efficacy at preventing infection: Beta, Gamma, Delta
Pfizer/BioNTech	94%	86%	85%	78%
Moderna	94%	89%	94%	80%
AstraZeneca	90%	52%	85%	49%
Johnson & Johnson	86%	72%	60%	56%
Sputnik-V	92%	81%	80%	70%
Novavax	89%	79%	79%	69%
CoronaVac	50%	44%	43%	38%
Sinopharm	73%	65%	63%	56%
Tianjin CanSino	66%	58%	57%	50%
Covaxin	78%	69%	68%	60%
Other mRNA vaccines	91%	86%	85%	78%
All other vaccines	75%	66%	65%	57%

Dose and interval and side effects

- **Pfizer(mRNA)**
- 5 to 11 years: Two 0.2 mL (10 mcg; orange cap formulation) doses 3 weeks apart. Booster dose not authorized
- 12 years and older: Two 0.3 mL (30 mcg; purple or gray cap formulation) doses 3 weeks apart. 5 months following the primary series
- **Common side effects:** Local injection site reactions
- Systemic symptoms (fevers, chills, fatigue, myalgias, headache)

Pfizer(mRNA)

- **Rare adverse effects:** Anaphylaxis (approximately 5 per million doses)
- Myocarditis/pericarditis (approximate risk):[5]
  - For males 12 to 16 years old: 71 cases/million doses
  - For males 16 to 17 years old: 106 cases/million doses
  - For males 18 to 24 years old: 52 cases/million doses
  - For males 25 to 29 years old: 17 cases/million doses
  - For females of the same age group: 2 to 11 cases/million doses

Dose and interval and side effects

- **AstraZeneca**
- This vaccine is based on a replication-incompetent chimpanzee adenovirus vector that expresses the spike protein.
- It is given intramuscularly and is being evaluated as two doses 4 to 12 weeks apart.
- The World Health Organization (WHO) recommends that the two doses be given 8 to 12 weeks apart

AstraZeneca

- Substantially reduced risk of symptomatic COVID-19 in the first several months after vaccination.
- In large placebo-controlled trials, vaccine efficacy of a two-dose primary series in preventing symptomatic COVID-19 at a median of two-month follow-up was 70 to 76 percent (95% CI 54.8-80.6) at or after 14 days following the second dose.
- The Delta (B.1.617.2) and Omicron (B.1.1.529) variants evade immune responses in some vaccinated individuals.

AstraZeneca

- In earlier-phase trials, fatigue, headache, and fever were relatively common after vaccine receipt and were severe in up to 8 percent of recipients.
- In the phase III trial, there were two cases of transverse myelitis in ChAdOx1 nCoV-19 vaccine recipients.
- The vaccine also may be associated with an extremely small risk of thrombotic events associated with thrombocytopenia,(4 TO 5 per million doses)

The Sinopharm COVID-19 vaccine

- 2 doses, administered at an interval of 21 days, have an efficacy of 79% against symptomatic SARS-CoV-2 infection 14 or more days after the second dose. Vaccine efficacy against hospitalization was 79%.
- This vaccine has not yet been evaluated in the context of circulation of widespread variants of concern.

Sinopharm adverse effects

- Side effects post first vaccine dose of normal injection site pain, fatigue and headache were more common in participants aged ≤49 years versus >49 years, while pain at the vaccination site, fatigue, lethargy, headache and tenderness were the most common side effects post second dose in both groups.
- All side effects for both doses were more prevalent among participants aged ≤49 years. Side effects were more common in females compared with males for both doses.

The Sinopharm COVID-19 vaccine

- **Can this vaccine be ‘mixed and matched’ with other vaccines?**
- To ensure equivalent or favourable immunogenicity or vaccine effectiveness either of the WHO EUL COVID-19 mRNA vaccines (Pfizer or Moderna) or the WHO EUL COVID-19 vectored vaccines (AstraZeneca Vaxzevria/COVISHIELD or Janssen) can be used as a second dose following a first dose with the Sinopharm vaccine dependent on product availability.

Omicron

- Significant reduction in neutralization by certain monoclonal antibody therapies:
  - Bamlanivimab-etesevimab: Inactive (>1013-fold decrease in susceptibility)[8]
  - Casirivimab-imdevimab: Inactive (>1013-fold decrease in susceptibility)[9]
  - Sotrovimab: No change in susceptibility[10]
  - Bebtelovimab: No change in susceptibility[11]
- Significant reduction in neutralization by sera from individuals with prior infection or from individuals vaccinated with a primary series (infection plus vaccination or primary series plus booster dose appears to restore some neutralizing activity)
- Lower risk of severe disease

Impact on transmission risk

- Widespread vaccination reduces the overall transmission risk, since vaccinated individuals are less likely to get infection.
- Previous data had also suggested that individuals who developed infection despite vaccination may be less likely to transmit to others, thereby further decreasing transmission risk.

Impact on transmission risk

- However, breakthrough infection with the more transmissible Delta variant is associated with a substantial risk of transmission that may be comparable to that of infection in unvaccinated individuals; the risk of transmission with a breakthrough Omicron infection is uncertain.

Thanks for your attention