COVID-19 VACCINES

There are several types of vaccines in use or under development for COVID-19, each with different strengths, weaknesses, and efficacy against viral variants.

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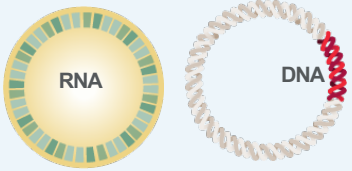
NUCLEIC ACID VACCINES

- Uses fragments of mRNA or DNA to produce an adaptive immune response through the host cells, producing copies of the target antigen
- Elicits both antibody and cytotoxic T-lymphocyte responses
- Need for boosters currently unknown in the general population but may be needed in the immunocompromised
- >90% efficacy in phase 3 trials and real-world efficacy studies with Moderna and Pfizer
- Good protection against severe disease and the Delta variant

Vaccines in use

- Moderna
- Pfizer/BioNTech

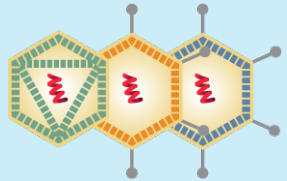


VIRAL VECTOR

- Uses modified non-coronaviruses (adenoviruses, vesicular stomatitis virus) expressing SARS-CoV-2 spike protein
- Elicits both antibody and cytotoxic T-lymphocyte responses
- Potential safety concerns (thrombosis, GBS), although overall safety is very high
- Excellent protection against severe disease
- Efficacy variable against variants; boosters may be needed

Vaccines in use

- Johnson & Johnson
- AstraZeneca/Oxford (UK, EU, India, Brazil, others)
- CanSinoBIO (China, others)

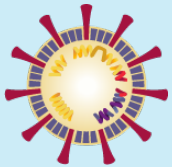


INACTIVATED VACCINES

- Uses a killed version of the virus to generate immunity
- Elicits neutralizing antibodies without a cell-mediated response
- Can be safely given to immunocompromised patients
- Proven vaccine technology already in use for several diseases (eg, hepatitis A, influenza, polio, rabies)
- WHO-approved but not used in North America or Europe
- Lower efficacy than mRNA; booster doses likely needed

Vaccines in use

- Chinese Academy of Medical Sciences
- Sinopharm
- Sinovac



PROTEIN

- Uses recombinant viral proteins to induce immune response
- Elicits neutralizing antibodies without a cell-mediated response
- Can be safely given to immunocompromised patients
- Proven vaccine technology already in use for many diseases (eg, hepatitis B, HPV, pertussis, herpes zoster)
- Very high efficacy and activity against variants reported in Novavax trials

Vaccines in development

- Sanofi/GSK
- Novavax
- Walter Reed Army Institute of Research (WRAIR)

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