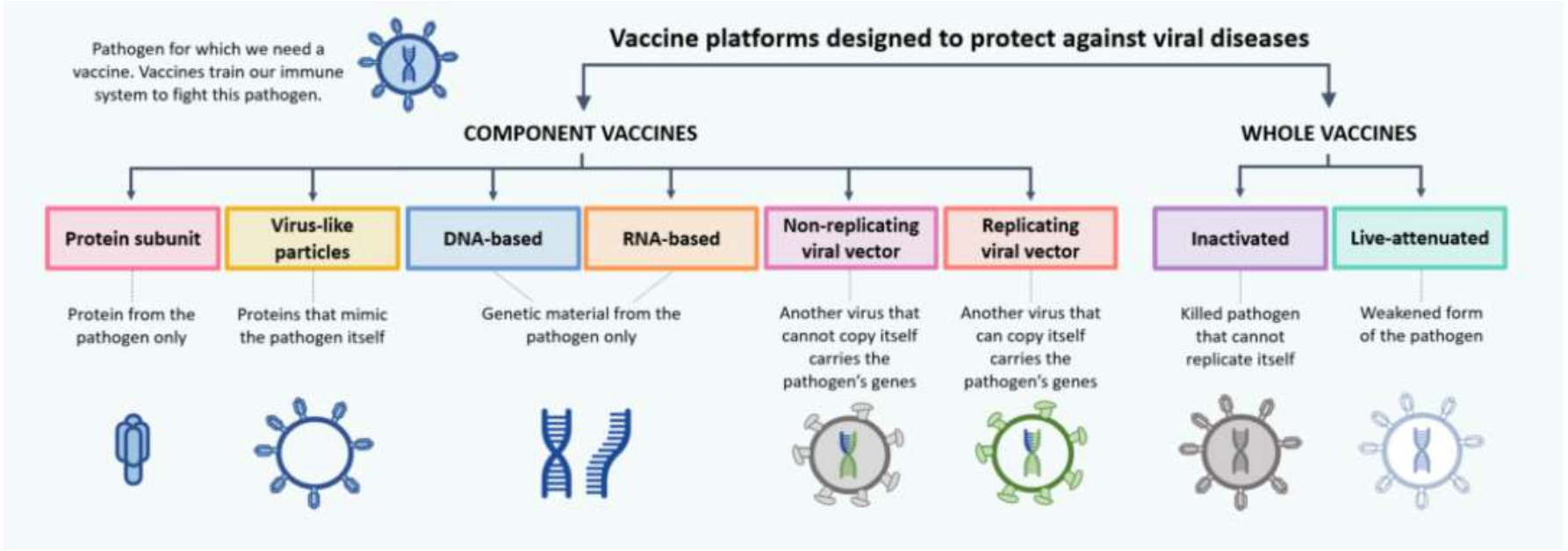
COMPARISON OF CORONA VACCINES

Points	COVAXIN	COVISHIELD	Tozinameran by Pfizer-BioNTech	MODERNA	Janssen	Vaxzevria / Oxford-AstraZeneca	Novavax	Sputnik V	Sinopharm & Sinovac
Type of Vaccine	Inactivated Virus	Viral vector	m-RNA	m-RNA	Viral vector	Viral vector	Protein	Viral vector	Inactivated Virus
WHO -Emergency Use Listing	No	15-Feb-21	31-Dec-20	12-Mar-21	12-Mar-21	19-Apr-21	-	-	7-May-21
Manufacturers	Bharath BiotechHyderabad & ICMR / NIV	AstraZeneca-Oxford Universityvaccine & Serum Institute of India	The German company BioNTech, the developer of the vaccine, partnered with the American company Pfizer for support with clinical trials, logistics, and manufacturing in US & Europe	Moderna and Lonza US	Janssen Biotech Inc, a Janssen Pharmaceutical Company of Johnson & Johnson- US.	Developed by Oxford University and AstraZeneca UK. Sold asVaxzevria and Covishield	GSK UK	Russia's Gamelya Center and bankrolled by the Russian government sovereign wealth fund	Sinofarm China
USFDA Emergency use approvals	No	No	12/11/2020 for 16 years and above. 12 years and above approval on 10 May 2021	18-Dec-20	27 Feb 2021, In early April, the CDC and FDA issued a joint recommendation for states to halt use of the Johnson & Johnson vaccine "out of an abundance of caution" during an investigation into reports of six rare, but serious clotting problems among women ages 18 to 48, occurring six to 13 days after vaccination. On April 23, FDA ended its recommended pause on the vaccine and will add a warning label about an uncommon, but potentially serious, blood clottingdisorder	No	No	No	No
Usage in Countries	Emergency authorization in India by DCGI on 3 jan 2021. Approved by Brazil's ANVISA. Approved in 9 countries.	Emergency authorization in India and no market use. Approved in 40 countries.	Emergency use in US & other countries. Approved in 85 countries.	Emergency use in US & other countries. Approved in 49 countries.	Emergency use in US & other countries. Approved in 42 countries.	Emergency use in Europe & other countries. Approved in 99 countries.	Under clinical trials	DCGI India recommended it for emergency use in India.Dr. Reddy's in India has partnered. Approved in 68 countries	Approved in 45/26 countries.
Age group	12 and above	18 and above	16 and above	18 and above	18 and above	18 and above	18 and above	18 and above	18-59
Storage	Refrigeration [2-8]	Refrigeration [2-8] for 6 months	- 80 to -60 degrees C [6 months] and 2-8 for upto 5 days.	-25 to -15 degrees C [6 months] and 2-8 for upto 30 days.	Refrigeration [2-8] for 3 months	Refrigeration [2-8] for 6 months	Refrigeration [2-8]	-18 C liquid form & 2-8 freeze dried form	Refrigeration [2-8]
Clinical Efficacv IControlled condts]	81%	70%	95%	94%	66%	63%	90%	91.60%	79 & 50%
Dosage	Two shots 0.5 mL each, 28 days apart	Two shots 0.5 mL each, 12-16 weeks apart	Two shots, 21 days apart	Two shots, 28 days apart	Single shot	Two shots, 4-12 weeks apart	Two shots, 3 weeks apart	Two shots, 21 days apart	Two shots,21 to 28 days apart.
Common side effects	Site pain, injection site swelling, redness, itching, stiffness in the upper arm, weakness in the injection arm, body ache, headache, fever, malaise, weakness, rashes, nausea, vomiting.	Pain, redness, itching, swelling or bruising, feeling unwell, fatigue, chills, fever, headache, nausea, joint pain, and muscle ache, but they are mostly mild to moderate in nature and can be treated with over-the-counter pills.	Chills, headache, pain, tiredness, and/or redness and swelling at the injection site, all of which generally resolve within a day or two of rest, hydration, and medications like acetaminophen. (If symptoms don't resolve within 72 hours or if you have respiratory symptoms, such as cough or shortness of breath, call your doctor.)	Similar to the Pfizer vaccine, side effects can include chills, headache, pain, tiredness, and/or redness and swelling at the injection site, all of which generally resolve within a day or two. On rare occasions, mRNA vaccines have appeared to trigger anaphylaxis, a severe reaction that is treatable with epinephrine (the drug in Epipens). For that reason, the CDC requires vaccination sites to monitor everyone for 15 minutes after their COVID-19 shot, and for 30 minutes if they have a history of severe allergies.	Fatigue, fever, headache, injection site pain, or myalgia (pain in a muscle or group of muscles), all of which generally resolve within a day or two.It has had noticeably milder side effects than the Pfizer and Moderna vaccines, according to the FDA report released in late February. No one suffered an allergic reaction in clinical trials for the vaccine, according to the company.	Tenderness, pain, warmth, redness, itching, swelling or bruising at the injection site, all of which generally resolve within a day or two.	While the Novavax vaccine is still being studied, early trials have shown no adverse events.	Most common side effects are flu like illness, headache, fatigue and injection site reactions.	Observed events were mostly mild to moderate and short lived.
How it works	Inactivated vaccine. It contains the dead virus, which prompts an immune response but doesn't infect or make the person sick.	Covishield is based on the viral vector platform. In simple terms, it is made from a weakened version of a common cold virus, called adenovirus, from chimpanzees and has been modified to look more like coronavirus.	This is a messenger RNA (mRNA) vaccine, which uses a relatively new technology. Unlike vaccines that put a weakened or inactivated disease germ into the body, vaccine delivers a tiny piece of genetic code from the SARS CoV-2 virus to host cells in the body, essentially giving those cells instructions, or blueprints, for making copies of spike proteins. The spikes do the work of penetrating and infecting host cells. These proteins stimulate an immune response, producing antibodies and developing memory cells that will recognize and respond if the body is infected with the actual virus.	Similar to the Pfizer vaccine, this is an mRNA vaccine that sends the body's cells instructions for making a spike protein that will train the immune system to recognize it. The immune system will then attack the spike protein the next time it sees one.	Scientists engineer a harmless adenovirus (a common virus that, when not inactivated, can cause colds, bronchitis, and other illnesses) as a shell to carry genetic code on the spike proteins to the cells (similar to a Trojan Horse). The shell and the code can't make you sick, but once the code is inside the cells, the cells produce a spike protein to train the body's immune system, which creates antibodies and memory cells to protect against an actual SARS-CoV-2 infection.	Similar to the Johnson & Johnson's vaccine, this is a carrier vaccine, made from a modified version of a harmless adenovirus. The final product contains the spike protein found in SARS-CoV-2. When that protein reaches the body's cells, the immune system mounts a defense, creating antibodies and memory cells to protect against an actual SARS-Cov2 infection	Unlike the mRNA and vector vaccines, this is a protein adjuvant (an adjuvant is an ingredient used to strengthen the immune response). While other vaccines trick the body's cells into creating parts of the virus that can trigger the immune system, the Novavax vaccine takes a different approach. It contains the spike protein of the coronavirus itself, but formulated as a nanoparticle, which cannot cause disease. When the vaccine is injected, this stimulates the immune system to produce antibodies and T-cell immune responses.	It is a viral two-vector vaccine based on two human adenoviruses, a common cold virus containing the gene that encodes the full-length spike protein (S) of SARS-CoV-2 to stimulate an immune response.	Inactivated vaccine. It contains the dead virus, which prompts an immune response but doesn't infect or make the person sick.

Stages of Phase trials for Vaccine roll out	
Pre-Clinical trials	Research-intensive stage is designed to find natural or synthetic antigens—foreign substances that induce an immune reaction in your body—that trigger the same reaction an actual virus or bacteria would. Identifying the right antigen or antigens can often take up to four years.
Phase 1 clinical trial	Phase 1 testing marks the first time the vaccine is tested in a small group of adults, usually between 20 to 80 people, to evaluate its safety and measure the immune response it generates.
Phase 2a	Phase 2a studies aim to determine the most effective dose, and expand the safety experience with the vaccine
Phase 2 B/ Phase 3	Before volunteers are vaccinated, they will be tested to make sure they currently do not have the SARS-CoV-2 virus. Half of the group will be assigned to receive the vaccine; the other half will receive a placebo. Then they will all be followed closely for up to two years to see if they do develop COVID-19-related symptoms, such as fever, headache, shortness of breath, dry cough or gastrointestinal distress.
Phase 4	After a successful Phase 3 trial, vaccine manufacturers submit an application to European Commission or USFDA. At this stage, clinical trial data is reviewed to make sure the vaccine is safe and effective
Variants of global concern as per WHO nomenclature	
Alpha- B.1.1.7	First found in UK Kent on Sep 2020. Spreads more rapidly than predominant virus.
Beta- B.1.351	First found in South Africa on May 2020. Shows significant resistance.
Gamma- P.1	First found in Brazil on November 2020. Shows some resistance, enhanced infectivity.
Delta- B.1.617.2	First found in India on October 2020. Significantly more transmissible, somewhat resistant.
Variants of global interest as per WHO nomenclature	
Epsilon-B.1.427/B.1.429	First found in US California on March 2020. May be more transmissible
Zeta-P.2	First found in Brazil on April 2020. May be more resistant.
Eta-B.1.525	Multiple countries in December 2020. May be more resistant to Vaccines.
Theta-P.3	First found in Philippines on Jan 2021. Has some of the same mutations as the other VOC's [Variants of concern].
Iota-B.1.526	First found in US New York on November 2020. May be more resistant.
Kappa-B.1.617.1	First found in India on October 2020. May be more resistant, spreads more readily.
Inference	1. All the vaccines have been given emergency approvals for prevention of human population from infection.
	2. Few vaccines are manufactured in a traditional established method e.g., Killed viruses. For the new type of Vaccines that are manufactured first time e.g m-RNA technology.
	3. All the vaccines are under studies to prove effective against all the mutant strains. If yes, good. If no, new vaccines have to be made very time!!
	4. Patient who had COVID positive had a reinfection of the mutated strain [Due to the mutation in the strains], which indicates the antibody response varies according to strain. This is the most worrisome factor to get rid of this.
	5. Point No-04 may be one of the reasons for few individuals getting COVID positive after vaccination [2nd booster dose] or might be due to the slow immune response in case of infection after the 1st dose.
	6. Point No-04 may be case of individuals getting COVID Positive second time.
	7. Study for longer period for how long the vaccines will provide the immunity is another question? Needs years!!!
	8. If any one of the vaccines is able to protect against all the variant mutants, then that will be the end of this COVID.
	9. Confirmation is needed for the RT PCR test, whether that can detect all the mutated strains of the Virus or the enzymes are very specific to the target in the test?
Disclaimer:	The above data compiled are from the various vaccine manufacturers and collected from the web. There is no intention to promote / degrade any vaccine manufacturer. Inference is based on the authors views/apprehensions and not to be used for any other purposes. It should serve as a handy tool for comparison.
Compiled by	Muthu
Compiled as on	07-June-21
Note	As on date, there are 122 corona vaccine candidates and 17 approved vaccines.


Pathogen for which we need a vaccine. Vaccines train our immune system to fight this pathogen.
Vaccine platforms designed to protect against viral diseases
COMPONENT VACCINES
WHOLE VACCINES
Protein subunit
Virus-like particles
DNA-based
RNA-based
Non-replicating viral vector
Replicating viral vector
Inactivated
Live-attenuated
Protein from the pathogen only
Proteins that mimic the pathogen itself
Genetic material from the pathogen only
Another virus that cannot copy itself carries the pathogen's genes
Another virus that can copy itself carries the pathogen's genes
Killed pathogen that cannot replicate itself
Weakened form of the pathogen