

VACCINES AGAINST COVID-19: A COMPREHENSIVE DISCUSSION



SUBMITTED BY

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REGISTRATION NO-201701010573 OF 2017-2018

COLLEGE- M.U.C WOMEN'S COLLEGE

For

BSC GENERAL 6TH SEMESTER BOTANY

(DSE 2) DISSERTATION

ACKNOWLEDGEMENT

I would like to express my special thanks of gratitude to my teacher Dr. Pritam Chattopadhyay as well as our principal Dr. Banibrata Goswami who gave me the golden opportunity to do this wonderful project on this topic, which also helped me in doing a lot of research and I came to know about so many new things.

I am really thankful to them.

Secondly I would also like to thank my parents and friends who helped me a lot in finishing this project within the limited time.

I am making this project not only for marks but to also increase my knowledge.

Thanks again to all who helped me.

SUMMARY

COVID-19 is the main problem in the whole world. To stop the spread of this disease vaccination is must be needed to each other. Safe and effective vaccines are the only way to protect the people in this disease.

This disease is spread rapidly one people to another by cough, sneeze, breathe etc. mainly its affected older people. Adult and children are not highly affected.

World Health Organization (WHO) and so many institutes are continuously working for the formation of modified vaccine. In the world many medical institute formed different vaccine after trailing but some of them are accepted by people.

Covishield, Covaxin, Sputnik-V vaccines are permit for the vaccination. Two dose of vaccine is must be needed every people and a maximum gap is present between two dose. some steps should be followed before and after vaccination.

19.07.2021

Certificate

This is here by certified that the dissertation entitled "VACCINES AGAINST COVID-19: A COMPREHENSIVE DISCUSSION" submitted by the student of B. Sc. semester six (University Roll No.170611610053) for partial fulfillment of the B. Sc. degree is done under my supervision. I wish her every success in life.



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INTRODUCTION:

Since the beginning of the corona virus disease 2019 (COVID-19) pandemic caused by severe acute respiratory syndrome coronavirus-2(SARS-CoV-2) (Structural and functional properties of SARS-CoV-2 Spike protein Cell. Moll. Immuno 2020). The world has taken significant measures to cope with this disease,

COVID-19 is the pandemic diseases in every country. Rapid development of vaccine is needed to stop this pandemic disease. This disease is first seen in 2019 and its speed very rapidly. After the spreading of this disease the world Health Organization declared it's a pandemic disease. The SARS-Co-V is the main virus to spread this. COVID-19 is effected people physically, economically and socially, therefore vaccines are urgently needed to end this pandemic. For the clinical trailing many COVID-19 candidates vaccines have been researched, tested, developed rapidly. After this rapid test trial several vaccines are approved by WHO and others are come closer to approval. To protect our body of this disease our immuno system is must be strong. So, we need to eat good and healthy food (like proteins), daily exercise and follow the rules of WHO. This is the second wave of this virus. According to WHO and CEPC the third wave become very soon. Researchers, Government and drug companies came together like never before co-operate and share resources, and making the testing process more efficient.

The fact that several COVID-19 vaccine candidate entered into clinical trainees than 6 months and were conditionally approved in 10 months since the beginning of COVID-19 out breaks demonstrates a record breaking speed in vaccine development history. This speed was facilitated by the timely release of the viral genomic sequence the availability of cutting-edge vaccine technologies, active among the global scientific community. The Coalition for Epidemic Preparedness Innovations is working with global health authorities and vaccine developers to support the development of vaccine against COVID-19.

DISCUSSION:

Rapid development of a vaccine against the viral pathogen Severe Acute respiratory syndrome coronavirus-2 (SARS-CoV-2), the cause of the coronavirus disease 2019 (COVID-19) pandemic, is essential, but rigorous studies are required to determine the safety candidate vaccines.

Conventional whole virus vaccines, including live-attenuated and inactivated vaccines are the oldest and most well established type of vaccine. In the case of vaccine developed against COVID-19, the inactivated whole SARS-Cov-2 is administered to individuals to elicit the immune responses. The immune responses are likely to target not only the S protein of SARS-coV-2, but also many other viral proteins researched by A Kumar and Z Andreadakis on 2020. Manufacturing of this COVID-19 is more time consuming and difficult because it takes times to grow the virus into large quantities and requires dedicated bio safety level production facilities. Forbidding clinical trial design and surveillance should provide a reliable strategy to identify adverse events, including the potential for enhanced severity of COVID-19 disease, after vaccination.

VACCINE DEVELOPMENT:

Generally the developing of a vaccine involves years of research. At first we need a vaccine candidate that is evaluated in animals for its safety. After a vaccine candidate passes pre-clinical trial then clinical trial phase. Then it approved which is taken for several months. Having lots of different vaccines in development increases the chances that there will be one or more successful vaccines that will be shown to be safe and efficacious for the intended prioritized population.

Flow chart of vaccine development:

Traditional process:

Target ID, development

Phase-1 (first trial in humans.).



Phase-2 (efficiency trials in humans).



Phase-3 (evaluation trail in human).



Phase-4 (license).

There are three main approaches to making a vaccine:

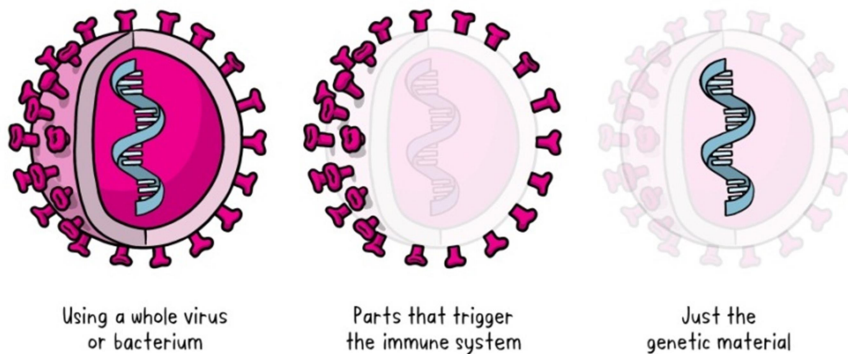


Figure 1: Main approaches to make a vaccine. (source – <https://www.who.int>)

THE DIFFERENT TYPES OF VACCINES:

There are three main approaches to designing a vaccine (<https://www.who.int>). Their differences lie in whether they use a **whole** virus or bacterium; just the **Parts** of the germ that

triggers the immune system; or just the **genetic material** that provides the instructions for making specific proteins and not the whole virus.

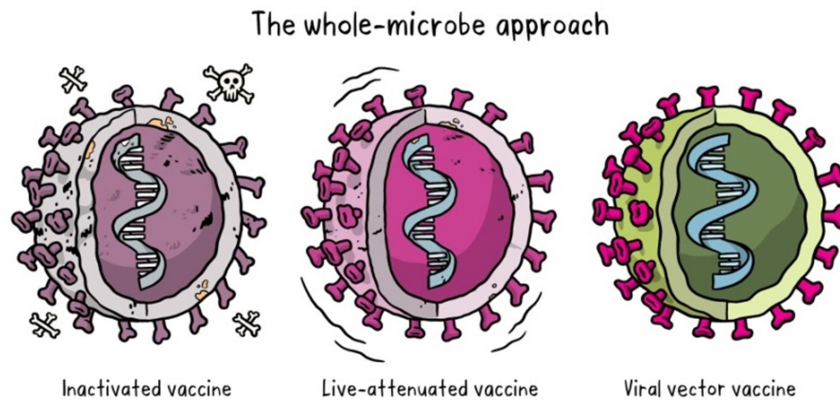


Figure 2: Different types of vaccine (source- <https://www.who.int>)

THE WHOLE MICROBE APPROACH:

(a) INACTIVATED VACCINE:

The first way to make a vaccine is to take the disease-carrying virus or bacterium, or one very similar to it, and inactivate or kill it using chemicals, heat or radiation. This approach uses technology that's been proven to work in people – this is the way the flu and polio vaccines are made – and vaccines can be manufactured on a reasonable scale.

However, it requires special laboratory facilities to grow the virus or bacterium safely, can have a relatively long production time, and will likely require two or three doses to be administered.

(b) LIVE-ATTENUATED VACCINE:

A live-attenuated vaccine uses a living but weakened version of the virus or one that's very similar. The measles, mumps and rubella (MMR) vaccine and the chickenpox and shingles vaccine are examples of this type of vaccine. This

approach uses similar technology to the inactivated vaccine and can be manufactured at scale. However, vaccines like this may not be suitable for people with compromised immune systems.

(c) VIRAL VECTOR VACCINE:

This type of vaccine uses a safe virus to deliver specific sub-parts – called proteins – of the germ of interest so that it can trigger an immune response without causing disease. To do this, the instructions for making particular parts of the pathogen of interest are inserted into a safe virus. The safe virus then serves as a platform or vector to deliver the protein into the body. The protein triggers the immune response. The Ebola vaccine is a viral vector vaccine and this type can be developed rapidly.

THE SUB UNIT APPROACH:

A subunit vaccine is one that only uses the very specific parts (the subunits) of a virus or bacterium that the immune system needs to recognize. It doesn't contain the whole microbe or use a safe virus as a vector. The subunits may be proteins or sugars. Most of the vaccines on the childhood schedule are subunit vaccines, protecting people from diseases such as whooping cough, tetanus, D.Phil meningitis.

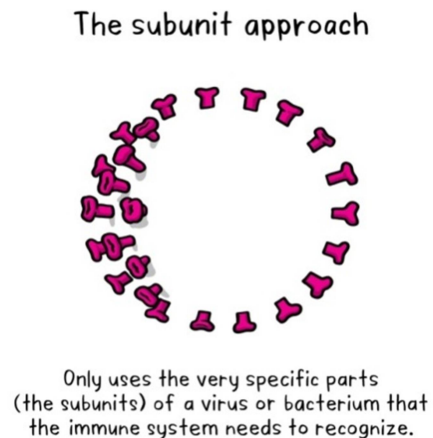


Figure 3: The subunit approach (Source – <https://www.who.int>)

THE GENETIC APPROACH (NUCLEIC ACID VACCINE):

Unlike vaccine approaches that use either a weakened or dead whole microbe or parts of one, a nucleic acid vaccine just uses a section of genetic material that provides the instructions for specific proteins, not the whole microbe. DNA and RNA are the instructions our cells use to make proteins. In our cells, DNA is first turned into messenger RNA, which is then used as the blueprint to make specific proteins.

A nucleic acid vaccine delivers a specific set of instructions to our cells, either as DNA or mRNA, for them to make the specific protein that we want our immune system to recognize and respond to.

The nucleic acid approach is a new way of developing vaccines. Before the COVID-19 pandemic, none had yet been through the full approvals process for use in humans, though some DNA vaccines, including for particular cancers, were undergoing human trials. Because of the pandemic, research in this area has progressed very fast and some mRNA vaccines for COVID-19 are getting emergency use authorization, which means they can now be given to people beyond using them only in clinical trials.

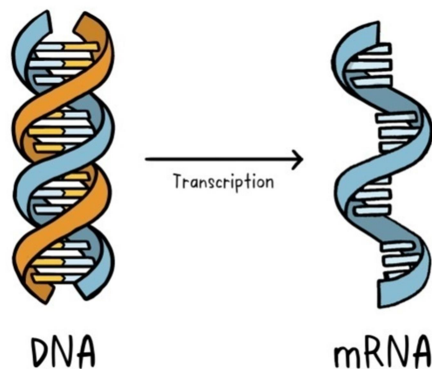


Fig4: DNA Transcription.(Source- <https://www.who.int>)

(COVID-19) VACCINE RESEARCH AND DEVELOPMENT:

In the past, vaccines have been developed through a series of steps that can take many years. Now, given the urgent need for COVID-19 vaccines, unprecedented financial investments and scientific collaborations are changing how vaccines are developed. This means that some of the steps in the research and development process have been happening in parallel, while still

maintaining strict clinical and safety standards. For example, some clinical trials are evaluating multiple vaccines at the same time. However, this does not make the studies any less rigorous. More information about COVID-19 vaccine development is available on <https://covid19.who.int/?gclid=EAlalQobchMi2p6220DvEAAYA>.

I. WHO'S VIEW IN HUMAN CHALLENGE STUDIES:

In a regular vaccine study, one group of volunteers at risk for a disease is given an experimental vaccine, and another group is not; researchers monitor both groups over time and compare outcomes to see if the vaccine is safe and effective.

In a human challenge vaccine study, healthy volunteers are given an experimental vaccine, and then deliberately exposed to the organism causing the disease to see if the vaccine works. Some scientists believe that this approach could accelerate COVID-19 vaccine development, in part because it would require far fewer volunteers than a typical study.

However, there are important ethical considerations that must be addressed – particularly for a new disease like COVID-19, which we do not yet fully understand and are still learning how to treat; it may be difficult for the medical community and potential volunteers to properly estimate the potential risks of participating in a COVID-19 human challenge study for more information.

II. APPROVED OF COVID-19 VACCINE:

This studies gives the information about the vaccine quality. A company developing COVID-19 vaccine also need to A company developing a COVID-19 vaccine also needs to provide detailed information about vaccine. This studies gives the information of vaccine active components, purity, controlling and manufacturing process and the best way how to store the vaccine. In this studies companies..

Non-clinical studies:

This study is normally depends on Laboratory study. It is tested some others animal before human trial. This method monitories whether there are any side effects just like reproduction process, development process, nervous system etc.

Three processes are normally followed in this studies.

Immunogenicity studies: In this study normally notice that the formation of antibodies after vaccination and changes of memory cell.

Animal-challenge studies: This process is explained the reaction of antigen- antibody in living cell and the change of living cell.

Bio distribution studies: It is a very simple process. This process showed how the vaccines reach the tissue and organs in the body.

Clinical studies:

Clinical study is done after pharmeectual and no clinical study. It is usually done by human body and show how safe and efficiency a vaccine.

National authorities and medical institute in each country researched and clinical studies for COVID-19 vaccine. In this process covid voluntaries are needed. At the trial period the volunteers should be vaccinated by different dose of vaccine. After vaccination them are place on under appropriate supervision. From time to time they are checked in fill body and noticing if there is any change in the body. If the antibody working successfully against COVID-19 antigen and recovered it then assumed that the vaccination process has been completed.

III. DISAPPROVAL OF COVID-19 VACCINE:

COVID-19 is growing rapidly and number of people are dies .In this reason safe and effective vaccines is critical to ending the COVID-19 pandemic, so it is hugely encouraging to see so many vaccines providing and going into development. WHO is working tirelessly with partner to develop, manufacture and deploy safe and effective vaccine.

In this pandemic situation many countries and many institutes are produced different types of vaccine to control this pandemic situation. But some are accepted by WHO and

other medical institute. But maximum are cancelled. Covaxin, Covishield, Sputnik V etc are accepted by WHO. Because this vaccine are follow the rules and protocol and all other steps of medical science and produced a particular way with maximum steps of clinical trials. This vaccines are given by the particular way to the people. WHO today listed the Sinopharm COVID-19 vaccine for emergency use, giving the green light for this vaccine to be rolled out globally. This vaccine produced by Beijing Bio-institute of Biological products co ltd. But some covid-19 vaccine are not approved by WHO because it should not follow the rules and protocol

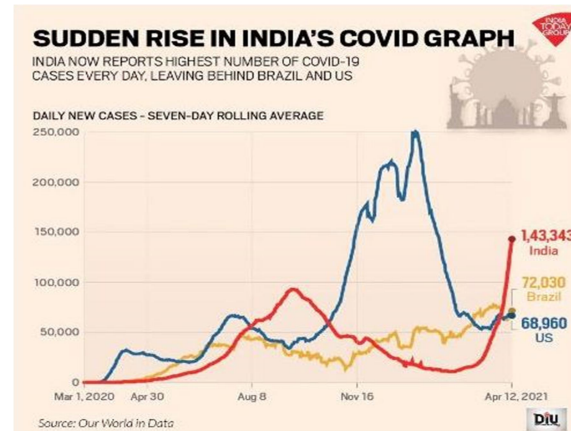
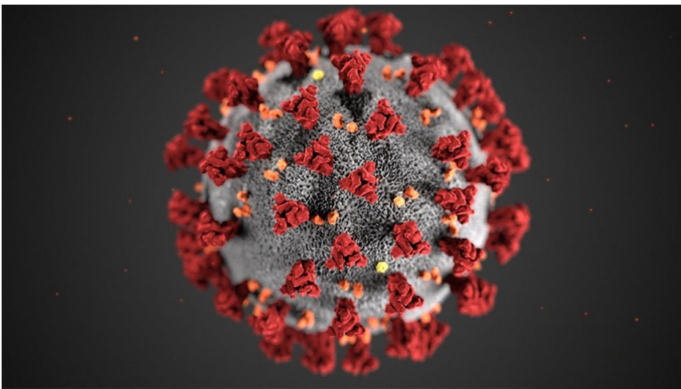
WHAT ARE THE INGREDIENTS IN THE VACCINES ?

<i>INGREDIENTS</i>	<i>PFIZERBLONTEC</i>	<i>MODERNA</i>	<i>ASTRAZENECAAN</i>	<i>JANSSEN</i>
<i>MEDICAL</i>	<i>mRNA</i>	<i>mRNA</i>	<i>Nonreplicatingviral vector(chad)</i>	<i>Non-replicatingviralvector .adenovirustype26(Ad 26)</i>
<i>Nonmedical LIPIDS</i>	<i>ALC0315 ALC0159apolyethyleneglycol(PEG) 12Distearoyl-sn-glycero-3-Phosphocholine(DSPC) CHOLESTEROL</i>	<i>12distearoyl-sn-glycero-3 Phosphocholine(DSPC) Cholesterol</i>	<i>Disodiumedetate(EDTA) Ethanol L-Histidine</i>	<i>2hydroxypropyl-B-cyclodextrin(HBCD)</i>
<i>SALTS</i>	<i>Diabasicsodiumphosphat edihydrate Monobasicpotassiumphosphate</i>	<i>Aceticacid Sodiumacetatehydrate Tromethaminehydrochloride</i>	<i>Magnesiumchloridehexahydrate Sodiumchloride</i>	<i>Sodiumchloride Sodiumhydroxide Trisodiumcitratedihydrate</i>
<i>SUGAR</i>	<i>Sucrose Waterforinjection</i>	<i>Sucrose Waterforinjection</i>	<i>Sucrose Waterforinjection</i>	<i>Waterforinjection</i>

COVID-19:

COVID-19 is a pandemic disease in all over world. The WHO announced it is a pandemic disease. Whole world is highly consul about this disease. The new name of this disease is corona virus disease 2019, summarized as COVID-19, in covid-19 CO stands for corona and VI for virus, and D for disease. This disease affected lots of people and killed also. This vaccine was first recognized in December 2019. Covid-19 is passed from an infected person to others by the cough, sneeze, talks, breathe etc (<https://www.who.int>).

In this disease main symptom is high fever. Most common symptoms is fever, dry cough, tiredness, diarrhea, loss of taste or smell, rash on skin etc. The main serious symptoms are difficulty breathing, chest pain and loss of speech. Older people and who have medical problem like high pressure, diabetes, cancer or any type of illness. The lungs is the most affected organ by COVID-19. SARS-CoV-2 is the seventh known human corona virus to infect people.



(Source – <https://www.who.int>)

VACCINE OF DIFFERENT COUNTRY:

The pandemic situation mainly occurs in 2020, in whole world. Most of the people are affected in this time. This is the first wave of COVID-19 but now its second wave. As of 2 June 2021, 2.02 billion COVID-19 vaccine doses has been administrated worldwide based on official reports from national health agencies collated by Our World in Data (<https://ourworldindata.org>). During a pandemic on the rapid timeline and scale of COVID-19 cases during 2020, international organizations like the World Health Organization (WHO) and Coalition for Epidemic

Preparedness Innovations(CEPI), vaccine developers, governments, and industry are evaluating the distribution of eventual vaccine. Individual countries are continuously changing the mechanism of vaccine for modified vaccine and provide first service to their own country. The WHO and CEPI are developing financial resources and guidelines for global deployment of several safe, effective COVID-19. In this pandemic situation every country produced different type of vaccine to control this diseases .But this pandemic situation WHO dose permission every type of vaccine for vaccinated. They can classify and examined it and then allowed this vaccine for vaccination. The United States authorized and recommended three type of vaccine in their country .This are Pfizer-Biotech, Moderna, Johnson &Jensen. In India the vaccine are covishield, Covaxin. CoronaVac and sinopharm are the mainstay of China’s vaccine. The others countries also produced different type of vaccine.

VACCINE:

- **COVISHIELD:**

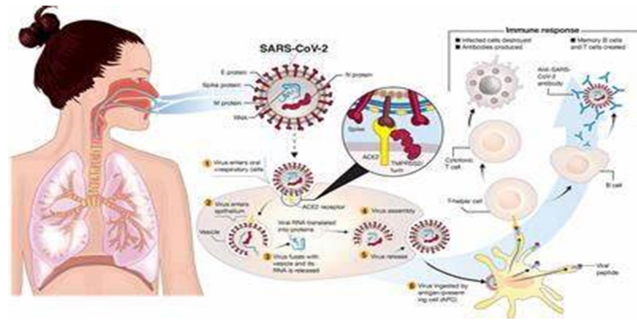
The world largest vaccine manufacture center the Serum Institute of India is being manufactured the Oxford-Astra-Zneca vaccine.

It is being produced more than 60 million doses a month. This vaccine is approved by WHO it follow all rules and protocol.

The vaccine is made from a weakened version of a common cold virus (known as adenovirus) from chimpanzees. It has been modified to look more like corona virus although it can’t cause illness. When the vaccine is injected a patient, it active the immune system to start making antibodies and primes it to attack any corona virus infection.

The jab is administered in two doses given between four and 12 weeks apart. It can be safely stored at temperature of 2C to 8C and can easily be delivered in existing health care setting such as doctor’s surgeries. International clinical trials of the Oxford-AstraZeneca vaccine showed that when people were given a half dose and then a full dose, effectiveness hit 90% (www.seruminstitute.com).

But there was not enough clear data to approve the half-dose, full dose idea.



(Source – www.seruminstitute.com)

COVAXIN:-

Bharat Biotech, a 24-year-old vaccine maker use a sample of coronavirus. Covaxin is an inactivated vaccine which means that is made up of killed corona virus, making it safe to be injected in our body.

When administrated, immune cells can still recognize the dead virus, prompting the immune system to make antibodies against the pandemic virus.

The two doses are given four weeks apart. The vaccine can be stored at 2C to 8C.

Bharat Biotech producing of 20 million doses of covaxin and is aiming to make 700 million doses out of four facilities in two cities by the end of the year 2021(www.bharatbiotech.com).

The manufacture and drug regulator had defended Covaxin, saying it was “safe and provides a robust immune response”.



(Source – www.bharatbiotech.com)

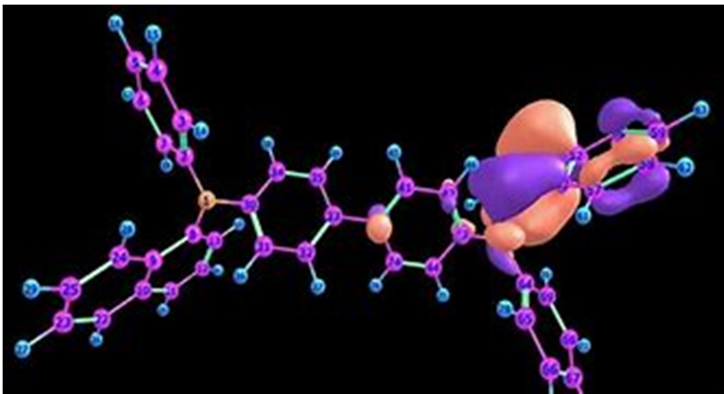
SPUTNIK V:-

The vaccine developed by Moscow's Gamelya Institute, initially generated some controversy after being rolled out before the final trial data had been released. It uses a cold type virus, engineered to be harmless, as a carrier to deliver a small fragment of the corona virus to the body. After being vaccinated, the body starts to produce antibodies especially tailored to the coronavirus. This means that the immune system is primed to fight coronavirus when it encounters it for real.

It can be stored at temperatures of between 2C and 8C degrees making it easier to transport and store. The Sputnik V jab uses two slightly different versions of the vaccine for the first and the second dose given 21 days apart.

They both target the coronavirus distinctive "spike" but use different vectors—the neutralized virus that carries the spike to the body.

Hyderabad-based pharmaceutical major Dr. Reddy's Laboratories will be importing the first batch of 125 million doses to India during this quarter. This vaccine is approved by WHO in later, it should follow rules.

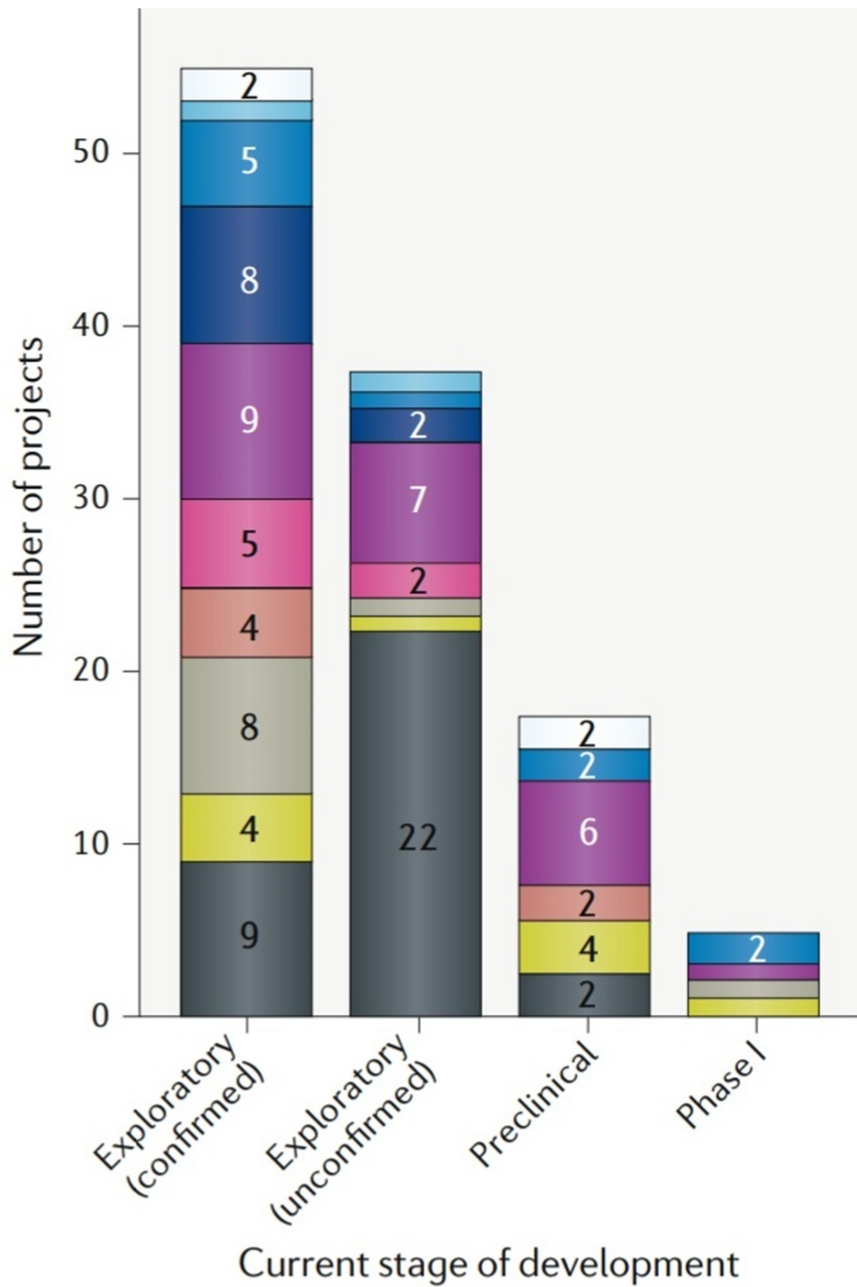


(Source - <https://sputnikvaccine.com>)

The COVID-19 VACCINE DEVELOPMENT LANDSCAPE:-

Authorities and vaccine developers to support the development of vaccines against COVID-19. The landscape provides insights into key The Connection for epidemic changes is working with global health characteristics of COVID-19 vaccine .As of 3rd September 2020 the global COVID-19 vaccine R&D landscape includes 321 vaccine candidates , of which 58 are confirmed ,of this 33 are preclinical stage (<https://www.who.int>). Considering the candidates in the novel platforms based on DNA or m RNA offer great flexibility in terms of antigen manipulation and potential for speed. Indeed Moderna started clinical testing of its m RNA based vaccine m RNA-1273 just 2 months after sequence identification .Vaccines based on viral vectors offer a high level of protein expression and long term stability, and induce strong immune responses. Finally, there are already licensed vaccines based on recombinant proteins for others diseases, and so such candidates could take advantage of existing large scale production capacity.

Public information on the specific SARS-CoV-2 antigens used in vaccine development is limited. Most candidates for which information is available aim to induce neutralizing antibodies against the viral spike(s) protein, preventing uptake via the human ACE2 receptors. It is unclear how different forms variants of the S protein used in different candidates related to each other. Experience with SARS vaccine development indicates.



(Source - www.nature.com)

VACCINES PROTECT AGAINST COVID-19:-

Every vaccines works in a particular way to identified the infection and after recognized the infection it produced antibodies. Normally the vaccines have not any side effect but COVID-19 is in clinical trials. So we should follow the protocols before and after vaccination. We have some crucial tips for being vaccinated.

SOME CRUCIAL STEPS BEFORE VACCINATION:

- According to the current vaccination status in India anybody above the age of 18 can get vaccinated from the 1st of May 2021.
- Registering for the vaccine is mandatory. Everybody should be register through the Co-win website <https://cowin.gov.in/home> or Arogya setu app.
- Do not take as an empty stomach .eat well as you go for your vaccine dose.
- Drink plenty of water and stay hydrated. get good and peaceful sleep at night.
- Avoid excess alcohol intake as it may dehydrated you.
- Be prepared to take any vaccine available at the centre at the given time.
- Carry the ID used for registration .visit the centre wearing a mask and maintain physical distance.

STEPS AFTER VACCINATION:-

- After vaccination, stay seated at the vaccination center for 15-30 minutes.
- Drink plenty of fluids and keep your body hydrated after the vaccination dose.
- Avoid consuming alcohol or smoking .Soothe your arm, you may place a cool or wet washcloth on the area.
- Be prepared for some minor side effects as your body builds immuno protection.

Ongoing studies on these COVID-19 vaccines indicate serious side effects found to-date are extremely very rare. People who have received this vaccine in these studies continue to be monitored for any longer term side effects.

CONCLUSIONS:

This review focuses on the details of COVID-19 vaccines. These pandemic diseases are very dangerous in our society. This disease propagates rapidly to stop the spread of COVID-19 we need maximum precaution. Always use mask, use mask every time and sanitize also. Keep social distance every time. The ability to manufacture hundreds of million to billions of doses of vaccine requires the vaccine manufacturing capacity of the entire world. Although new technologies and factories can be developed to sustain production, there is an immediate need to fund the necessary manufacturing including the steps that provide vaccine products for distribution. The vaccination process is growing rapidly in every country and each country produced different type of vaccine which vaccine is certified by World Health Organization. Vaccination is must in every people so we can take vaccine in time, to live a beautiful healthy life.

Remember that the vaccine is merely a prick. After vaccination download the vaccination certificate. Although if anybody received both doses of the vaccine, remember to take preventive measures especially in public places. Remember that vaccination dose not ensure complete immunity. So, always use mask.

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