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# IMAMIA MEDICS INTERNATIONAL ACADEMIC COUNCIL NEWSLETTER

*The official newsletter of the Journal of Medics International, part of Medics International Academic Council*

## A Message from Chair of International Academic Council


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Dear readers,

We are honored to present the Academic Council's first edition of our newsletter.

Submissions are encouraged from scholars at all stages of their research journeys. The newsletter is part of the educational mission of Medics International that includes the Journal of Medics International (JMI) and Sadiq International Virtual University (SIVU) activities. Our goal is to educate and unite our readers from around the world.

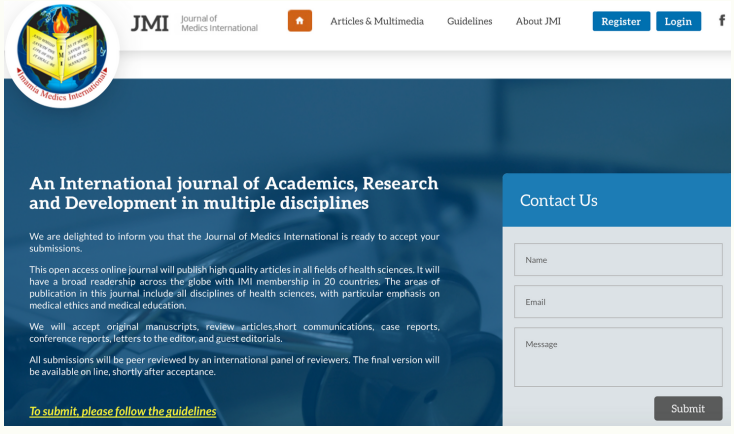
The team went through a rigorous process of vetting, editing and finalizing the submissions that we present to you today.

The Academic Council encourages you send brief reports for the newsletter, full articles for JMI, and presentations for SIVU in your field of expertise. The brief reports can be a summary of articles you have published with a key figure, a brief review of important developments in your field, or an opinion piece. All submissions will undergo peer-review.

Please contact **academiccouncilJMI@gmail.com** for submission details, or visit **www.jmi.imamiamedics.com**

## INSIDE THIS ISSUE:





# A Brief Introduction to COVID-19 Vaccines



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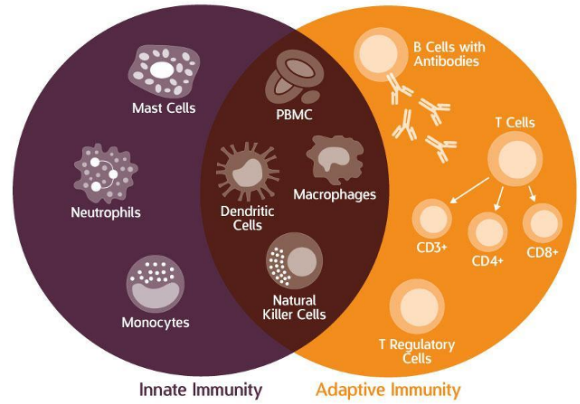
## Part 1: Acquired Immunity Explained

- To understand how COVID-19 vaccines work, it helps to first look at how our bodies fight illness with the help of White Blood Cells (WBCs). Different types of white blood cells fight infection in different ways:
  - **Macrophages** are white blood cells that swallow up and digest germs and dead or dying cells. The macrophages leave behind parts of the invading germs called antigens. The body identifies antigens as dangerous and stimulates antibodies to attack them.
  - **B-lymphocytes** are defensive white blood cells. They produce antibodies that attack the pieces of the virus left behind by the macrophages.
  - **T-lymphocytes** are another type of defensive white blood cell. They attack cells in the body that have already been infected.
- The first time a person is infected with the virus that causes COVID-19, it can take several days or weeks for their body to make and use all the germ-fighting tools needed to get over the infection.
- After the infection, the person's immune system remembers what it learned about how to protect the body against that disease. The body keeps a few T-lymphocytes, called **memory cells**, that go into action quickly if the body encounters the same virus again.
- When the familiar antigens are detected, B-lymphocytes produce antibodies to attack them. Experts are still learning how long these memory cells protect a person against the virus that causes COVID-19.
- It typically takes a few weeks for the body to produce T-lymphocytes and B-lymphocytes after vaccination. Therefore, it is possible that a person could be infected with the virus that causes COVID-19 just before or just after vaccination and then get sick because the vaccine did not have enough time to provide protection.
- Sometimes after vaccination, the process of building immunity can cause symptoms, such as fever, body aches and soreness on the arm. These symptoms are normal and are a sign that the body is building immunity.

Cells of the Innate and Adaptive Immune Systems




- After the covid vaccination or recovery from the covid-19 illness the immunity is expected to last for the life-time of the individual. But it is too early to tell at present, as there have been a few cases of reinfection reported.
- Almost all the vaccines target the spike glycoprotein (S-protein) of the Corona Virus SARS-CoV2 causing the Covid-19 disease.
- This S-protein is fairly well conserved in all the strains (which are in thousands!) of corona viruses that have been isolated and studied so far during this pandemic and does not show significant mutations. Corona viruses have a special proof-reading function making it 10X less likely to have major mutations compared to other RNA viruses.
- This is good news as there may not be a need for a new variant of the covid vaccine periodically. Unlike the Flu (influenza) which has to have a new vaccine every season due to antigenic shifts, antigenic drifts and the 100+ combinations in the H & N surface protein combinations (H1N1, H7N9 etc.). So the corona virus S-protein targeted vaccines are much more likely effective and longer lasting as compared to Flu vaccines.
- The corona virus has another surface protein called Hemagglutinin-Esterase (HE) Dimer which can also produce an immunogenic response.
- Individuals who have recovered from Covid-19 illness may not need to take the vaccination.
- People who have had an asymptomatic infection may just need one dose of the vaccination as a booster to induce the secondary response (equivalent to the second dose of normal vaccine protocol).

- **Active Immunity** (Vaccination)
  - **DNA Vaccine** (Inovio)
  - **RNA Vaccine** (Moderna, Pfizer)
  - **Viral Vector** (Oxford/AstraZeneca, Janssen, Gamalaya-Sputnik)
  - **Viral Subunit** (Novavax, AdaptVac, Clover Biopharma, Sanofi)
  - **Live Attenuated** (Codagenix, Indian Immunologicals Ltd.)
  - **Inactivated Virus** (SinoVac, SinoPharm, Bharat Biotech)
  - **VPL (Virus Like Particles )** ( Medicago Inc.)
  - **Split Virus Vaccines** (e.g. Flu Vaccines)
  - RNP (Ribonucleoprotein) Vaccine.
- **Passive Immunity** (Antibody Administration)
  - Antibodies
    - Monoclonal Antibodies (e.g. Bamlanivimab)
    - Polyclonal Antibodies (e.g. Regeneron)
  - Convalescent Plasma
  - **mRNA Induced Antibody** (M.I.T.)

| NUCLEIC ACID | Risks | Immune Response | Manufacture |
|---|---|---|---|
| DNA Vaccine | Risk of integration/Mutation | Moderate | Special Facility |
| mRNA Vaccines | Safe | Strong | Easy to produce |
| Viral Vector Vaccines | Risk of integration/Mutation | Strong | Easy to produce |
| RNA Induced Antibody | No Risk of integration | Fast but Moderate ? | Unknown |
| **PROTEIN VACCINES** | **Risks** | **Immune Response** | **Manufacture** |
| Viral Sub-Units | Very safe | Strong | Easy to produce |
| Split Virus Vaccines | Fairly safe | Moderate to Strong | Current infrastructure |
| VLP Vaccines | Very safe | Moderate to Strong | Difficult |
| **VIRON VACCINES** | **Risks** | **Immune Response** | **Manufacture** |
| Live Attenuated | Risk of infection | Robust response | Current infrastructure |
| Inactivated | Safe | Strong | Special Facilities |

### DNA Vaccines

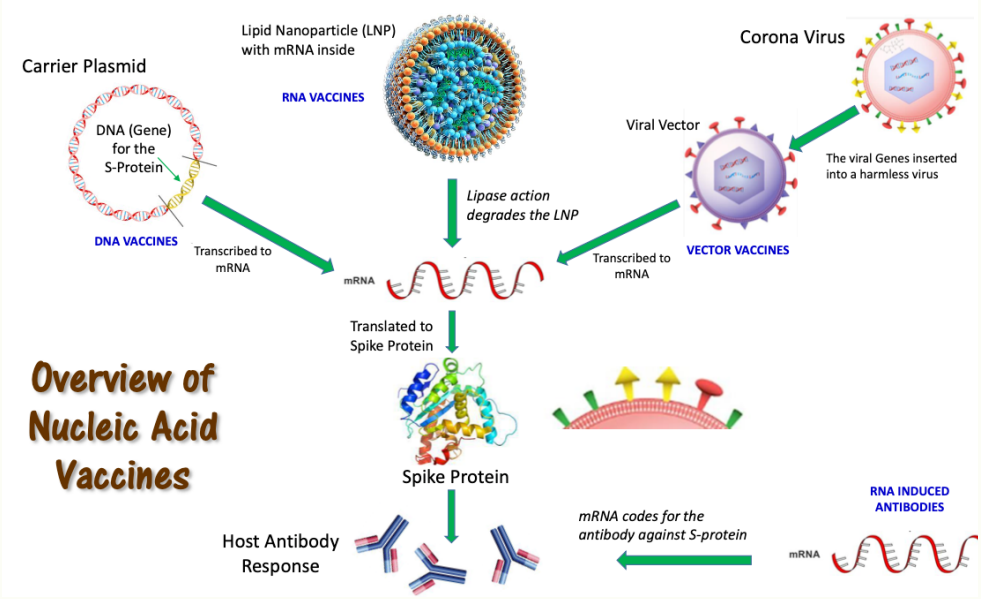
DNA vaccines are made up of small strands of DNA. Actually the gene encoding the antigen of interest (in this case the Spike Protein or S-Protein, of the Covid-19 Coronavirus). The gene is attached to a plasmid for delivery into the body. The Plasmid is used so that the body does not degrade the foreign gene before it can provoke an immune response.Once administered the DNA are taken up by host cells which produce the S-Protein, and then reflect the antigen (S-Protein) on its cell surface, thus stimulating an antibody and T cell response. Inovio Pharma (USA) is developing the DNA vaccine INO-4800. DNA Vaccines need a special delivery system, and the Inovio vaccine is Intra-Dermal (ID).

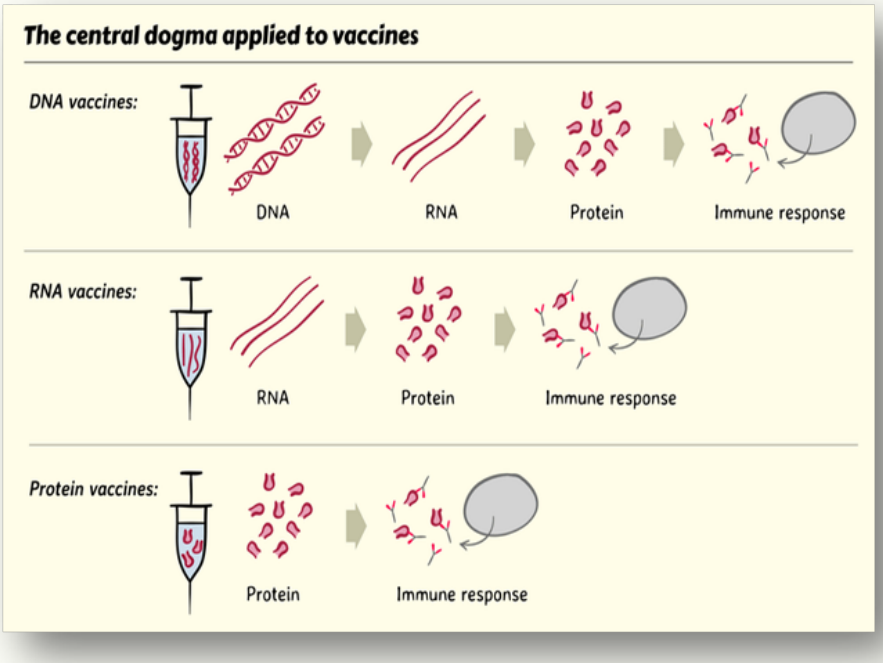
### mRNA Vaccines

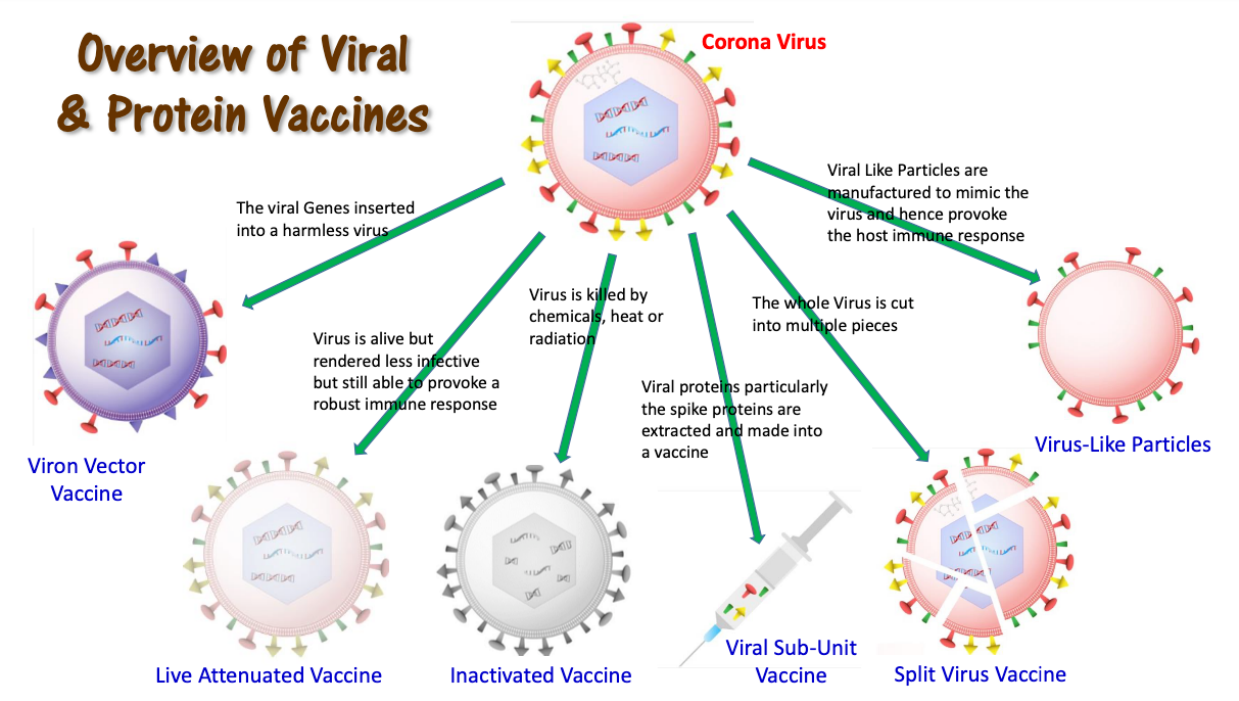
RNA vaccines consist of an mRNA encoding the antigen of interest (The Corona Virus Spike protein or the S-Protein). This is placed in a Lipid Nanoparticle (LNP) vehicle. The LNP prevent the mRNA degradation by the host until it is taken up by the cell. Once administered the RNA are taken up by host cells. The intra-cellular lipases degrade the LNP exposing the mRNA. The mRNA is then translated into the S-protein, which is then reflected on the cell surface, stimulating an antibody and T cell response. Moderna has developed the mRNA-encapsulated in a lipid nanoparticle vaccine. The RNA used is the viral RNA, Isolated and spliced to give the exact gene. Pfizer/BioNTech, RNA Vaccine uses an mRNA that is genetically engineered in the Lab from the sequenced viral genome. It is also enclosed in Lipid Nanoparticles.The gene being packaged is for the S protein.

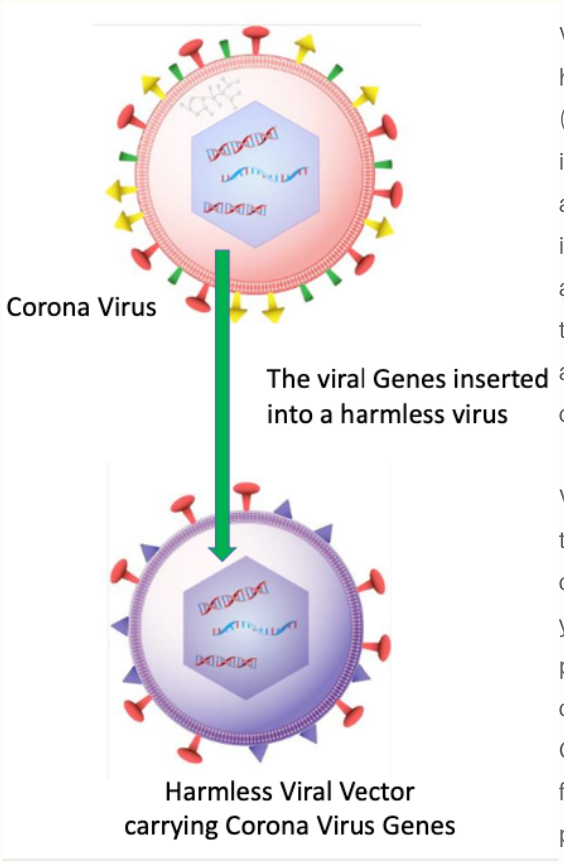
### RNA & DNA Vaccines

DNA and RNA vaccines, however, present some challenges. As there are currently no approved DNA or RNA vaccines, it is unclear how effective they will be in vaccinating a population against COVID-19 or how quickly they can be scaled up.In addition, naked genetic material alone is unlikely to produce strong immune responses and memory as they can be quickly degraded outside cells and need to cross cell membranes to produce and shuttle the antigen on the cell surface. There are some safety concerns that DNA vaccines may get integrated into the host's genome and cause mutagenesis. But this will need a special enzyme called Integrase, which is present in only certain viruses like the retroviruses RNA vaccine mRNAs cannot get integrated into the human genome as this process will need a reverse transcriptase, to make DNA from the mRNA. This another special enzyme present in only a few viruses like Retroviruses and Reversiviruses (Hepatitis B Virus).






**Vector Vaccines**

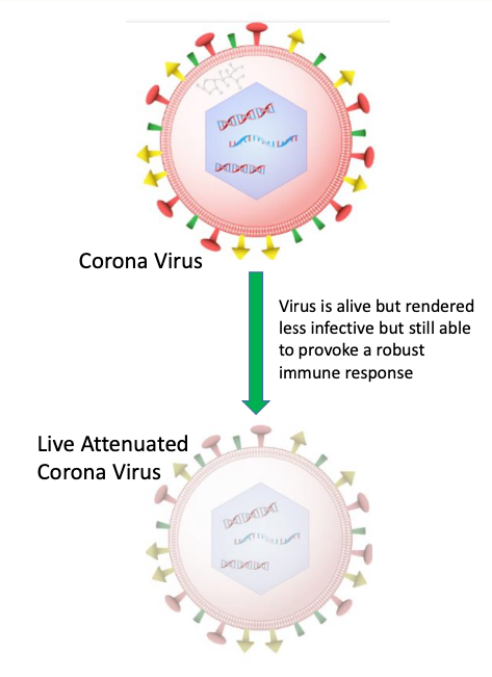
Viral vector vaccines are similar to live-attenuated vaccines in that they use a harmless virus known as a vector, to carry a gene encoding the antigen of interest (S-Protein). When the vector virus infects a cell, they administer this foreign gene into the cell. The cell then transcribes and translates the gene to produces the antigen (s-protein), which is then displayed on the cell surface to stimulate an immune response.The infected cell may also slowly reproduce the virus which allows more cells to become infected and produce more antigen, thus amplifying the effect.The Oxford/AstraZeneca, Gamalaya-Sputnik and the Janssen vaccines are all Vector Vaccines. They use a harmless adenovirus as a vector for gene delivery.

Viral vector vaccines are a new vaccine technology with only one vaccine of this type currently approved for clinical use. Dengvaxia is a dengue vaccine that consists of two genes from the dengue virus being expressed in an attenuated yellow fever 17D viral strain. The vaccine is only given to people who were previously infected with dengue as it has been shown to cause severe complications and dengue infection among uninfected people.Two well-known COVID-19 vaccine candidates are viral vectors, both of them possessing the foreign gene for the S protein. AZD1222, developed by Oxford University, in partnership with AstraZeneca contains a gene for the whole S protein that is expressed in a non-replicating chimpanzee adenovirus.

Gam COVID Vac (Sputnik) is another COVID-19 viral vector vaccine that is developed by Gamaleya Research Institute, Russia.

The vaccine consists of the gene for the whole S protein that is contained in two different recombinant human adenoviruses administered separately. Similar to live-attenuated vaccines, viral vector vaccines can stimulate strong antibody and T cell responses as the virus is able to (slowly) infect cells to produce and display the S protein on the cell surface. This allows both B and T cells to be activated, producing strong immune responses and memory. There are some obstacles, though, in approving viral vector vaccines for use in humans.

Like live-attenuated vaccines, viral vector vaccines cannot be used in immunocompromised or immunosuppressed people as the immune system is unable to contain the slow replication of the viral vector. The viral vector vaccine may also be less effective in people with pre-existing antibodies against the viral vector, preventing it from infecting cells to generate immune memory against the SARS-CoV-2 virus.Viral vector vaccines are quite complicated to produce. They require specialized facilities to produce the viral vector vaccine and maintain its purity. The Vectors with the inserted gene are considered a Genetically Modified Organism (GMO) that carries a potential risk to the environment, it is also subject to strict environmental regulation and risk management.




**Live Attenuated Vaccines**

Live attenuated vaccines contain a live but less infective form of the same virus. These vaccines have all the components of the original pathogen, but they possess mutations that reduce their ability to replicate inside the body, so they will not reproduce natural infection. It is a proven vaccine technology used to vaccinate people against many infections such as polio, chickenpox and tuberculosis. As of the beginning of September 2020; however, only three COVID-19 vaccines are live attenuated vaccines with none entering clinical trials in the U.S. One of these is being developed in Griffith University, in collaboration with Indian Immunologicals Limited in Hyderabad, India, where parts of the SARS-CoV-2 genome are mutated to reduce but not abolish the ability of the SARS-CoV-2 virus to replicate in human cells. Codagenix is also developing Live Attenuated Vaccines which are also not yet in clinical trials.

Live Attenuated Vaccines: Advantages & Disadvantages

Live-attenuated vaccines present some advantages to combating COVID-19. A single dose of the vaccine is sufficient to protect the person against COVID-19 as it has all the components of the original SARS-CoV-2 virus to generate strong antibody and T cell responses. This generates long-lasting immunity to COVID-19 due to the mass proliferation of memory B and T cells. At the same time, a live attenuated COVID-19 vaccine, once approved, can be quickly produced at scale as existing methods and facilities are available to produce live attenuated vaccines.There are also disadvantages associated with a live attenuated COVID-19 vaccine. The production of live attenuated vaccines requires biosafety-level facilities to safely produce the vaccine. Cold storage facilities are also required to maintain stability of a live attenuated COVID-19 vaccine, limiting the global distribution of the vaccine. Also, a live attenuated COVID-19 vaccine cannot be given to immunocompromised or immunosuppressed patients as the attenuated SARS-CoV-2 virus can slowly replicate, exceeding the immune system's ability to contain the pathogen. Lastly, there is the risk that the attenuated SARS-CoV-2 virus can accumulate mutations while it replicates to revert back to its infective form, reproducing infection. This is the case for the oral polio vaccine. As it accumulates mutations inside the body, the vaccine can become pathogenic to humans. causing vaccine-derived polio.

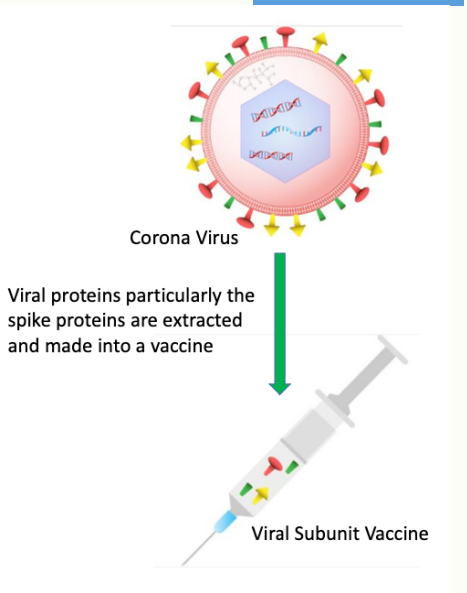
**Inactivated Vaccines**

Evolving from live-attenuated vaccines that are able to (slowly) replicate in the body, inactivated vaccines contain a whole virus that is killed or inactivated by chemical, heat or radiation.This eliminates the possibility of the pathogen replicating and possibly causing infection, yet the vaccine still has all the components of the original pathogen to induce a memory response. Various inactivated vaccines are available to vaccinate people against infections such as cholera and hepatitis A. Following in these footsteps is the CoronaVac, produced by SinoVac R&D Co, SinoPharm vaccine, and the vaccine from Bharat Biotech (Hyderabad, India)CoronaVac contains the inactivated SARS-CoV-2 virus that is combined with alum (aluminium salt). Alum acts as an adjuvant to stimulate immune responses against the vaccine.

Inactivated vaccines are considered safer to use than live-attenuated vaccines with fewer side effects. This is because the vaccine components cannot replicate inside the body, eliminating the possibility of infection. Inactivated vaccines can also be stored at room temperature as the pathogen is dead and non-replicative. This eliminates the need for refrigeration, allowing the vaccine to be distributed to more remote areas of the world.On the other hand, as the inactivated pathogen cannot replicate inside the body, more than one dose of the inactivated vaccine is required to give the body time to develop immune memory against the SARS-CoV-2 virus. In addition, specialized biosafety-level facilities are needed to firstly grow the pathogen and then inactivate it at scale. Lastly, inactivation of the pathogen may alter the shape of the antigens which may be different from the original version. Hence, the body may not generate the correct immune memory response against the original SARS-CoV-2 virus.

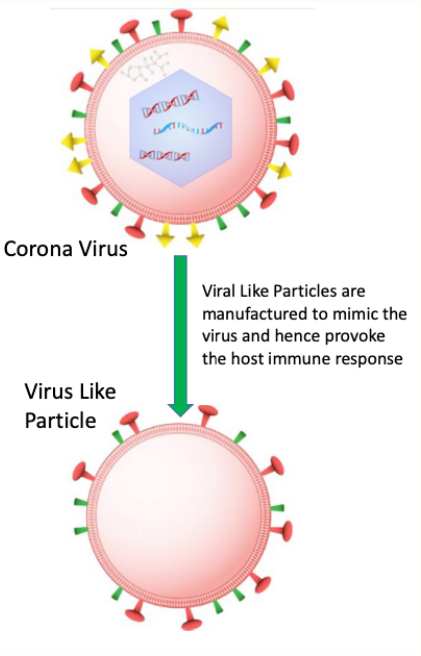
**Viral or Protein Subunit Vaccines**

Subunit vaccines take parts of the Virus (antigens) that simulate an immune response and inject them into the body. Most subunit vaccines consist of proteins from the pathogen (such as the SARS-CoV-2 S protein, but they can also be fragments of bacterial toxins (toxoids) or pathogenic components such as the cell wall. Some of the COVID-19 vaccine candidates are subunit vaccines are being developed by Novavax, Clover Biopharmaand Sanofi /Glaxo-Smith-Kline.Both vaccines contain the whole S protein of the SARS-CoV-2 virus combined with an adjuvant, a chemical that enhances the immune response to the vaccine.Subunit vaccines produce strong antibody responses as the antigens are collected, processed and presented to B cells to stimulate antibody production. Nevertheless, they are safe to administer as the whole pathogen is not injected, so it will not cause infection. Lastly, they are simpler and cheaper to produce as only parts of the pathogen need to be produced.




**VLP Vaccines (Virus Like Particles)**

Virus-like particle: This type of vaccine contains molecules that mimic the virus but are not infectious and, therefore, not a danger. VLP has been an effective way of creating vaccines against diseases such as human papillomavirus (HPV), hepatitis and malaria.Virus-like particles (VLPs) are synthetic nanostructures, like Lipid-Nanoparticles, Dendrimers or Fullerenes. They are made to resemble the Virus Antigen and trick the immune system.They are composed of structural proteins that can be arranged in several layers and can also contain a lipid outer envelope. VLPs trigger a high humoral and cellular immune response due to their repetitive structures. A key factor regarding VLP safety is the lack of viral genomic material, which enhances safety during both manufacture and administration.The Quebec based company Medicago Inc. uses a plant-based platform to develop their vaccines. This approach uses living plants as bioreactors to produce non-infectious VLPs. These VLPs mimic the architecture of a virus but are non-infectious. Medicago's vaccine candidate is currently in Phase 2 clinical trials. They have been granted permission to launch Phase 2/3 clinical trials on November 12th, 2020.




**Split-Virus Vaccines**

The vaccine is made by cutting the virus into several pieces. All the fragment of the virus are present but in a random mixture. So they cannot cause the disease but provoke an immune response. No company is currently working on the split Virus Vaccine technology for the coronavirus.

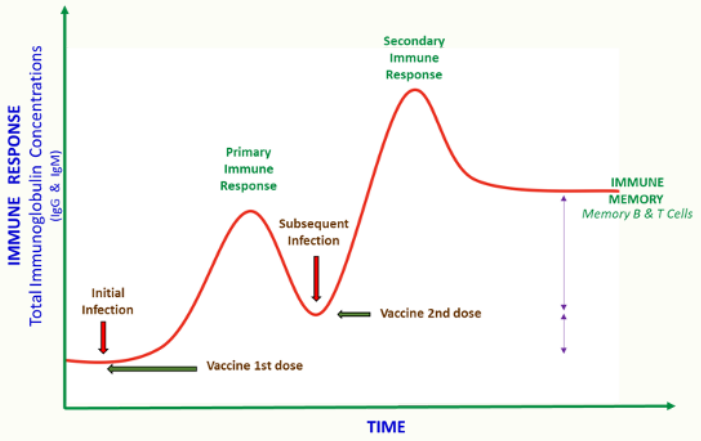
The advantage of this type of vaccine is the virus is inactive, while all viral elements are present to produce a strong immune response.It is difficult to determine the right dose though and moreover, this type of vaccine is not easy to produce.The only current example of this kind of vaccine is the influenza vaccine (Flu vaccine).

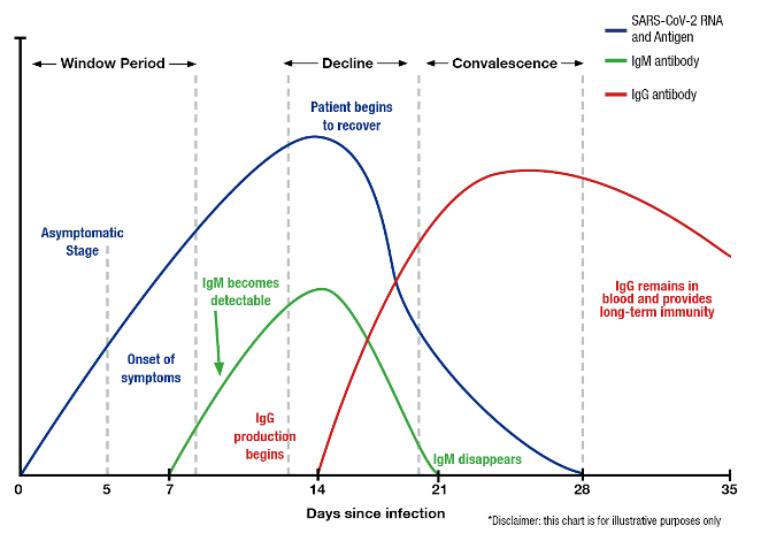
**mRNA Induced Antibody**

This is another novel vaccine concept being explored by M.I.T.The mRNA here is not coding for the antigen of interest (e.g. the viral S-protein), instead it codes for the actual antibody against the S-protein.The mRNA enters the host cell and makes multiple copies of the antibody or the specific Immunoglobulin (against the Virus s-protein).This process bypasses several steps of the host immune response by directly making the antibodies of interest and start the fight against the virus.Risks and benefits are similar to the other RNA vaccines except that it behaves like passive immunity (by producing the antibody itself) and may have a much faster response time!

**Why Two Doses ?**

Depending on how many times the body is exposed to the virus or vaccinated, the body can generate two types of immune responses.The body generates a primary immune response when exposed to the SARS-CoV-2 virus for the first time or gets the 1st dose of the vaccine. The primary immune response is slow and weak as it takes days for the body to generate enough antibodies and T cells to eliminate the virus. However, the body generates long-lasting memory B and T cells that "remember" the SARS-CoV-2 virus, generating immune memory. When the virus enters the body for the second time or the 2nd dose of the vaccine is given, the body develop a secondary immune response. The secondary immune response is stronger and quicker than the primary immune response as memory B and T cells are rapidly activated. This results in higher antibody concentrations and T cell counts around the body to eliminate the virus more quickly, reducing the symptoms and severity of COVID-19. In addition, more memory B and T cells are produced after infection which strengthens memory of the SARS-CoV-2 virus.  It is the development of immune memory that is key to how a vaccine works!!

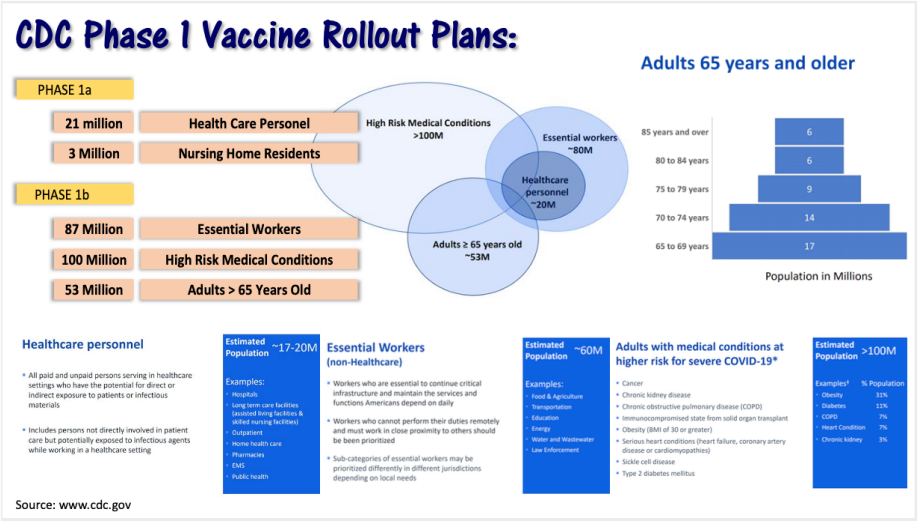


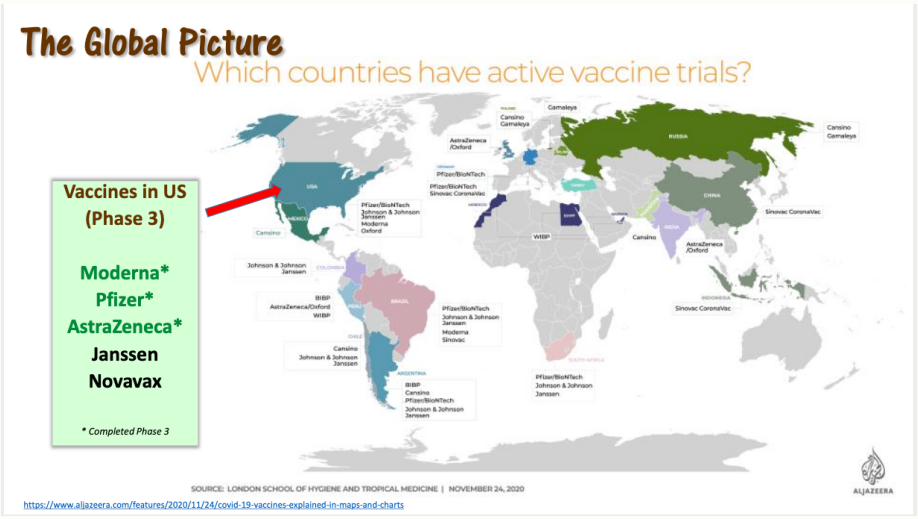




**Why Multiple Vaccines?**

A variety of COVID-19 vaccines are being developed around the world. According to WHO, as of November 12th 2020, there are 48 vaccines in Clinical Trials and 164 candidate vaccines in Pre-clinical evaluations. All of them share one thing in common: they all stimulate a primary immune response so that the body can develop memory B and T cells against the SARS-CoV-2 virus.The development of immune memory by vaccines is what will protect the person against subsequent COVID-19 infection.

Each COVID-19 vaccine has distinct advantages and disadvantages, but the development of different COVID-19 vaccines provides some redundancy and overlap.In case a vaccine is unsafe in humans or fails to protect people against COVID-19, the world has other COVID-19 vaccines that it can trial and produce. It is this pursuit of multiple vaccines that will allow the global population to be immunized sooner, allowing COVID-19 to be eliminated so that the world can start to recover from the pandemic!



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Once available, vaccine distribution follows guidelines recommended by the **CDC** (Centers for Disease Control) and developed by the Advisory Committee on Immunization Practices (**ACIP**).

Vaccine distribution areas include the 50 states, District of Columbia, and eight US territories. During the H1N1 pandemic in 2009, doses were distributed according to population in each distribution area.

The CDC recommends vaccinating the highest-risk populations first. A priority list is then phased out.

Before a vaccine is widely available, **Compassionate Use Authorizations** (CUA), **Emergency Use Authorizations** (EUAs) and **the strategic national stockpile** are designed to streamline responses during a crisis and mitigate the most severe cases.

**BARDA** (Biomedical Advance Research & Development Authority), a government agency, provides national funding for companies and programs dedicated to developing drugs, vaccines and antivirals.

The **FDA** (Federal Drug Administration) issued EUAs authorizing use without trials and testing for healthcare professionals to test patients for antiviral drugs.

Vaccine development moves through established pipelines that require rigorous safety and efficacy testing before public availability. After identification of a vaccine candidate, **pre-clinical studies** in cultured cells and animals ensure the vaccine elicits an effective immune response without being toxic, before clinical trials begin in humans. At this point, the FDA recognizes the vaccine as an **Investigational New Drug** (IND).

The **Phase 1 Clinical Trial** assesses risk factors or adverse effects, what dose is required, whether this dose is the same for different individuals, and if the vaccine promotes healthy immune systems to make antibodies. The Phase 1 trial for the Moderna vaccine began in record time, just two months after the sequence of the virus was published.

If there are no risk factors or adverse effects in Phase 1 trials, **Phase 2** and **Phase 3** trials expand to more volunteers, increasing statistical power. Each phase has built-in objectives and endpoints and volunteers are monitored for months. After Phase 3, the vaccine must receive FDA approval before licensing and distribution.

Then, **Phase 4 Clinical Trials** is the last phase and includes ongoing studies of risk and side effects after the vaccine is distributed.

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# COVID-19 Pandemic: Nursing Perspectives


## Tabassum Merchant, ARNP

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The COVID-19 pandemic may be considered the single most significant healthcare issue of our generation. Of note, healthcare workers have been particularly adversely affected. A once rarely considered piece of equipment, the face mask, has taken the center stage in the healthcare, economic, and political realms. Masks are a necessary tool for controlling infection spread, particularly in the medical and inpatient settings. As a result, healthcare workers in hospitals, assisted living facilities, nursing homes, skilled nursing facilities and outpatient surgical centers are wearing masks for entire shifts. It is prudent to note that masks were never intended to be worn continuously, therefore skin injury and comfort have not been taken into account during mask design and production.

**Skin conditions and PPE use:**

Skin conditions attributed to continuous mask usage include pressure injuries, dermatitis, moisture-associated skin damage, itching and hives. PPE-related skin conditions include but are not limited to dermatitis, eczema, infections, acne and pressure ulcers. Little is known at present regarding prevention of these injuries. Skin irritation, contributing to inadvertent scratching and touching of these areas may provide a portal for Coronavirus penetration, as recently suggested in an editorial in the Journal of Wound Ostomy and Continence Nursing. This article summarizes guidelines provided by the Nurses Specialized in Wound, Ostomy and Continence Canada (NSWOCC) and the Wound Ostomy and Continence Nurses Society. However, it is the responsibility of each healthcare professional to verify with their institutional infection control team that measures undertaken to prevent or manage PPE-related skin injuries do not interfere with the efficacy of the PPE and are not contraindicated by any workplace policy.

**Prevention Strategies:**

**Hands:**

Prior to donning gloves and PPE, remove nail polish and artificial nails and wash hands with soap. Avoid jewelry and watches. Hand moisturizing skin care products may be applied frequently to minimize risk and occurrence of irritant contact dermatitis. Optimal hand cream should have a fat content of approximately 70%.

**Face:**

Moisturizers should be applied 1-2 hours prior to application of the facial protective equipment (FPE) as doing this within 1-2 hours of FPE may impair the seal or the movement of the FPE. Also moisturize at the end of the shift following a shower. Facial areas to be protected should be free of any creams, oils or makeup. Using a wipe rather than spray, apply alcohol-free barrier film (Cavilon no sting barrier film, Smith and Nephew no sting barrier film, Brava skin barrier film) to the entire face carefully avoiding the eyes. Allow the film to dry for 90 seconds before using the FPE. Application of alcohol-free barrier film should be done only once a day. Using wipes rather than sprays allows better control. Application of a dressing under the FPE is discouraged as it may interfere with the seal of the FPE. The barrier film protects intact and damaged skin from moisture, adhesive trauma and friction and forms a breathable transparent coating.


**References & Bibliography:**

Prevention and management of skin damage related to personal protective equipment: update 2020 by NSWOCC

Journal of wound ostomy continence Nursing 2020: 47(4): 317-318.Journal of Wound Ostomy and Continence Nursing. Available at: http://nswoc.ca/journal-of-wocn/