Covid-19 Vaccine –Update

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Introduction

Covid-19 has taken the world by storm ever since the first case was discovered in China back in November 2019; it has propagated into the largest pandemic to occur since a century. The virus had spread to the entire world by March 2019 and since then has taken many lives and caused immense damage to many livelihoods, along with most countries adopting new safety measures such as social distancing, wearing face masks and reducing the number of times we go out of our homes. With all these difficulties comes a need for a permanent solution, for which a vaccine has been the frontrunner. Now, countries have eased restrictions but Covid-19 cases have been on the rise with no end in sight. With many organizations racing to produce a vaccine, the question arises, are we there yet?

Vaccine Development

Since a long time, the creation and mass production of a vaccine has been a long and arduous process, taking anywhere between 10 and 15 years. However, with a pandemic of this gargantuan scale, the time has to be cut short, down to a year. So far, the mumps vaccine has been the fastest developed vaccine that took 5 years. This further goes to show **how onerous of a challenge is developing the covid-19 vaccine.**

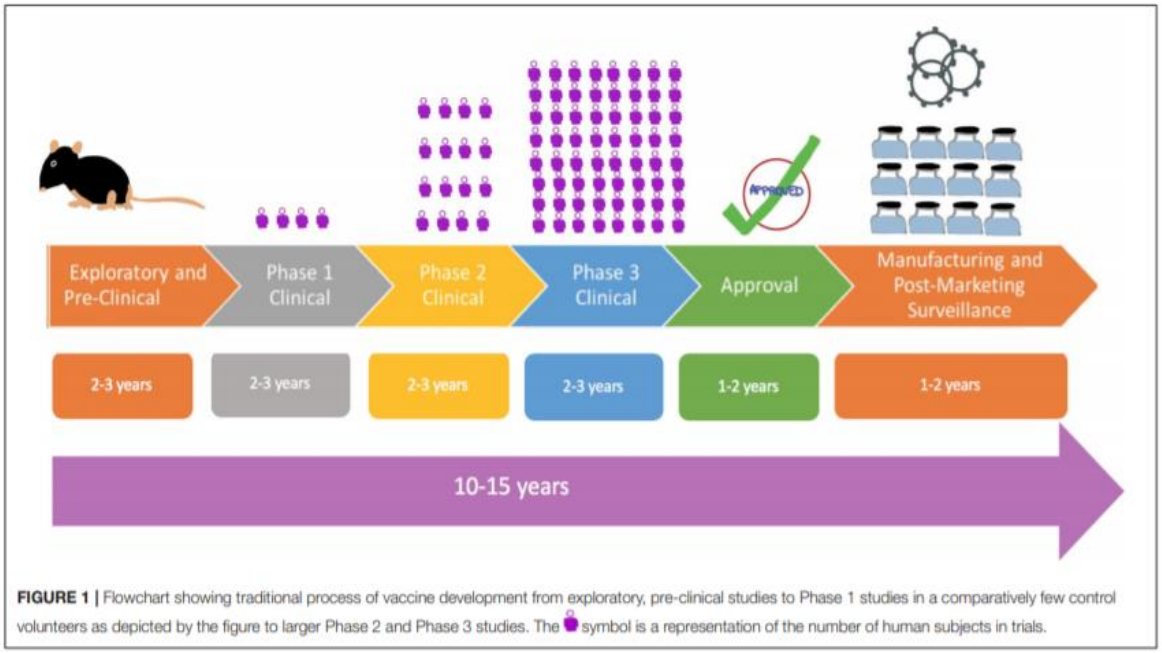

FIGURE 1 | Flowchart showing traditional process of vaccine development from exploratory, pre-clinical studies to Phase 1 studies in a comparatively few control volunteers as depicted by the figure to larger Phase 2 and Phase 3 studies. The symbol is a representation of the number of human subjects in trials.

Figure 1. The above flowchart points out the time taken and the traditional process of approving a vaccine.

Types of Vaccine

There have been numerous types of vaccines being studied including RNA, DNA, Inactivated and non-replicating viral vectors. Below is a graphic showing the various types and the organizations that have chosen the particular platform for producing the vaccine (**Figure 2**).

Previously, RNA and DNA vaccines have not been developed for human use but in a pandemic situation, these seem to be the best bet given their fast approval process and a strong immune response. On the other hand, inactivated vaccines have been produced earlier but they do not have a similar immune response unless used along with an adjuvant.

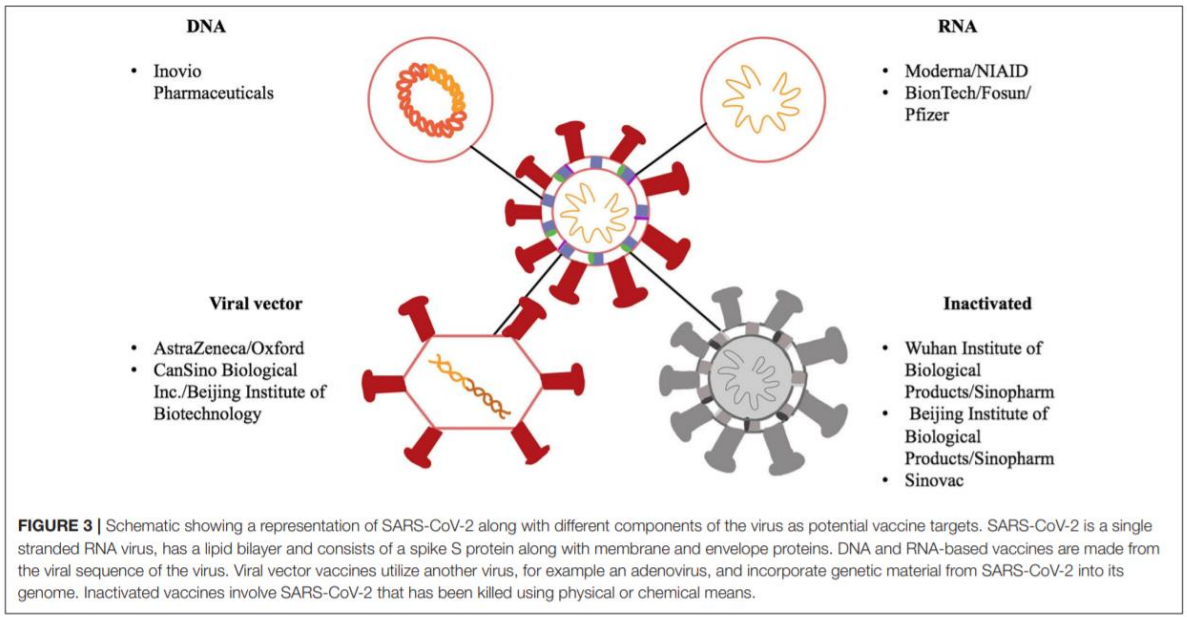

FIGURE 3 | Schematic showing a representation of SARS-CoV-2 along with different components of the virus as potential vaccine targets. SARS-CoV-2 is a single stranded RNA virus, has a lipid bilayer and consists of a spike S protein along with membrane and envelope proteins. DNA and RNA-based vaccines are made from the viral sequence of the virus. Viral vector vaccines utilize another virus, for example an adenovirus, and incorporate genetic material from SARS-CoV-2 into its genome. Inactivated vaccines involve SARS-CoV-2 that has been killed using physical or chemical means.

Figure 2. Graphic showing the various types and the organizations that have chosen the particular platform for producing the vaccine

How do these vaccines work?

Inactivated Vaccines:

These work by making the virus non-infectious through a chemical or physical approach. In the context of Covid-19, thus far inactivated vaccines have proven to be effective and have shown good antibody numbers. The adverse reactions have been minimal.

Live Attenuated Vaccines:

Such vaccines are produced by reducing the virulence of the virus rather than completely nullifying it, such vaccines, however may elicit a viral response in some individuals.

Nucleic Acid Vaccines:

These vaccines are delivered into human cells, where they get transcribed to Viral proteins. For CoV proteins, the S protein has been the most encouraging and prevalent.

Vector Vaccines:

Vector vaccines are constructed from a carrier virus such as the pox or adenovirus, and carry a gene from the virus, S gene being the most common.

Which vaccines are ready?

So far, seven vaccines have been approved for mass production and public usage, with Pfizer, Moderna and Sinopharm being at the forefront. Since vaccine, development is such a complicated process, accelerating its production and skipping milestones may cause a public health catastrophe, but with proper monitoring and usage, these vaccines can provide immense benefit.

Moderna Vaccine

This mRNA-based vaccine (mRNA-1273) has been developed in collaboration with National Institute of Allergy and Infectious Disease (NIAID) and has successfully passed the phase 3 clinical trials. It is a two-dose vaccine taken 28 days apart.

Pfizer Vaccine

It is a nucleoside modified mRNA-based vaccine developed by BioNTech and Pfizer called the BNT162b2, given intramuscularly 21 days apart. It provides an immune response by encoding a mutated form of the full spike protein of the virus. This particular vaccine has shown promising results, with IgG levels increasing after the second dose. Some side effects like fatigue, chills, and joint pains have been recorded. Currently, the vaccine has been approved for emergency use in the USA, UK and few other countries.

Sinopharm Vaccine

Sinopharm and Wuhan Institute of Virology have produced an inactivated vaccine, with the phase 3 clinicals being conducted in UAE, China and a few other countries extensively. Now, the UAE government for public use has approved the vaccine and the government has started campaigns. It has an efficacy of 86%.

Conclusion:

Since most vaccine-preventable diseases are transmitted person-to-person, effective vaccination not only protects the recipient but also indirectly protects others who cannot be

vaccinated or do not respond adequately by preventing another source for transmission ("herd immunity"

Vaccines to prevent severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) infection are considered the most promising approach for controlling the pandemic. SARS-CoV-2 vaccine development is occurring at an unprecedented pace.

Vaccines to prevent SARS-CoV-2 infection are considered the most promising approach for controlling the COVID-19 pandemic. Various vaccines are available in different countries are COVID-19 mRNA vaccines BNT162b2 (Pfizer-BioNTech COVID-19 vaccine) and mRNA 1273 (Moderna COVID-19 vaccine) [1,2]. Each is given as two intramuscular doses separated by a few weeks. In large placebo-controlled trials, these vaccines had 95 percent efficacy in preventing laboratory-confirmed symptomatic COVID-19 after the second dose [3]. Local and systemic adverse effects (pain, fever, fatigue, and headache) are common but usually non-severe. Initial vaccine supplies are limited; in the United States, health care personnel and long-term care facility residents are prioritized for vaccination.

Lately the authorities of Europe have reported SARS-CoV-2 VUI 202012/01(new SARS-CoV-2, variant 01 in Dec 2020), WHO, 2020 [4]. This variant is thought to spread more rapidly and research is underway to understand if this variant is linked to deviance in severity of clinical presentation, antibody response or vaccine efficacy.

References:

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