

A STUDY ON DIFFERENT VACCINES OF COVID-19

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ABSTRACT

Scientists and researchers all around the world had been putting every effort to devise a potent vaccine to keep the highly infectious viral disease at bay. The elusive nature and frequent unpredictable genetic mutations of the novel Corona virus had made this task truly cumbersome. Heavyweight research laboratories all around the world were in search of finding a true cure to the viral disease, and it was often realised that developing herd immunity would be too lengthy and thus too risky a process. Different types of vaccines were tried to be developed by various organisations. While there remains the uncomfortable question of how much effective the quick-fix vaccines would be, especially when multiple strains are being discovered from various countries, the short range success of the scientists and researchers is certainly worth acclaim. This study attempts to shed light on all those vaccine types and the manufacturers involved in the research.¹

KEYWORDS : Vaccine, Covid-19, herd immunity, research laboratories

INTRODUCTION

According to the report of WHO, there were 660,905 new infections throughout the world and the report of John Hopkins University showed that the number of infections had crossed 54,299,446 on 14th November. There was also news of a few new strains' outbreak in many countries. Almost whole of 2020 passed on cohabiting with the panic of Covid-19, people all around the world was eagerly waiting for an effective vaccine to protect from the viral disease. The rapidly mutating virus has been too elusive for the scientists to conduct stable research and experiments on its epidemiology so far. Protection against Covid-19 infection through developing herd immunity has largely been ruled out due to its associated risk, unethical procedure and unpredictable nature of the novel Corona virus. Therefore, only a vaccine can free the ongoing mayhem from the wreck of Covid-19.

OBJECTIVES OF THE STUDY

There have been **misconceptions about herd immunity** which is developed not by exposing a large part of the community to an infectious pathogen, but by developing immunity through vaccination of a part of the community, who would contribute to arrest the spreading of the disease to the rest of the community who could not be vaccinated for various reasons. Herd immunity varies from disease to disease. In case of Measles, herd immunity is required of 95% of the population whereas, for Polio, it is 80%.²

Soon after the onset of the pandemic, various research organizations worldwide had plunged into devising out Covid-19 vaccines but the fast mutation of the Corona virus led scientists completely baffled to follow a specific research pattern. The objectives of the present study are:

- To find out how vaccines work.
- To find out about different types of Covid-19 vaccines.
- To find out about the chief candidates in the vaccine research.³

DELIMITATIONS OF THE STUDY

Forced with the home-confinement and lockdown, considerable difficulty was encountered to reach and access the libraries. Reliance on chiefly secondary sources of information and a surge of Infodemic, where false information often shadowed the genuine ones sometimes delimited the smooth conduct of the study.

RESEARCH METHODS

Bibliographic research has been taken up for this study. News paper reports, research articles, journals and books of eminent scientists and scholars, online publications and audio and video telecasts have been referred to apart from the World Health Organisation (WHO) and UNICEF reports and newsletters to collect facts for this present study.

ANALYSIS AND RESULTS**What are Vaccines?**

Vaccines are actually live, attenuated or killed, inactivated or conjugated viral or bacterial proteins or toxoids (inactivated bacterial toxins) that are applied into the host's body to develop immune response. The weakened, attenuated or inactivated viral or bacterial protein is unable to cause the disease but its introduction triggers the body's immune system which identifies the antigen (the viral or bacterial particle), keeps the identity in memory (through Memory B Lymphocytes) and uses that memory to defend the body the next time the same pathogen attacks.

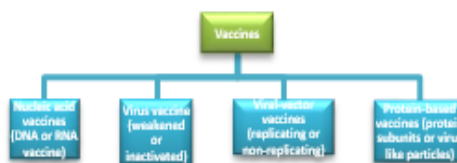
Vaccines Types:

Fig 1: Different types of vaccines⁴

There are a number of candidates attempting to design Covid-19 vaccine, like the Pfizer and its German partner BioNTech, Moderna Inc. of US, AstraZeneca-Oxford University's ChAdOx1 vaccine (Serum Institute of India is tied to it), Gamaleya National Research Institute of Epidemiology and Microbiology of Russia working on Sputnik-V (Dr. Reddy's in India is working with it), Johnson and Johnson and many other local and small-scale research laboratories. The virus is a novel one, and the most antigenicity has been detected in its characteristic spike protein that docks on the host cell and infects it. This spike protein gene being relatively stable to undergo mutation and has a conserved region, scientists all around the world are targeting this.

Table 1: Different global candidates working on different types of Covid-vaccines:

Vaccines	The Candidates	The Process
Nucleic acid vaccines	20, also Pfizer-BioNTech and Moderna (RNA vaccination)	In DNA vaccine technology, the SARS-Cov-2 spike protein gene is extracted from the Corona virus and it is incorporated inside the host cell through electroporation, which then makes the targeted SARS-Cov-2 protein that elicits the required immune response. DNA plasmid with targeted gene can also be injected intramuscularly. In RNA vaccine technology the mRNA instead of DNA carrying the necessary information for the targeted protein is inserted inside the host cell packed within a lipid coat to facilitate entry and then trigger immune response and it is inserted inside the cell with the almost similar technique of using viral vectors. ⁵
Virus vaccine	7, also Sinovac Biotech in Beijing	The already existing Polio or measles vaccine is like this when the live virus in an attenuated or inactivated form is injected inside the host body. They are using an attenuated SARS-Cov-2 virus to develop Covid vaccine.
Viral-vector vaccines	25, also AstraZeneca-Oxford, Sputnik-V of Russia and Johnson and Johnson	A related mild adenovirus has been genetically transformed to create Corona virus protein inside host body without the risk of causing the disease itself but capable of creating the desired immune response. Ebola vaccine is an example of replicating viral-vector vaccine. Using monkey adenovirus instead of human adenovirus increases the chance of immunity boosting which is less or unlikely with human adenovirus.
Protein-based vaccines	28	The spike protein subunit of Corona virus or its specific receptor binding site that would also need adjuvants is coupled with the viral-protein to elicit the desired immune response. Five candidates are using empty Corona viral shells to mimic the Corona virus (Virus-Like-Particles or VLP).

FINDINGS

According to WHO, there are at least **150 players** worldwide that are working on to design Covid-19 vaccines and almost 70% of them are private players.⁷

- **Pfizer and BioNTech** are hopeful to bring their vaccine in 2021 April which they claim would be 90% capable of protecting against Covid-19 with a global target of 300

million doses.

- **Moderna Inc.** was at phase III and eyeing for developing 20 million doses of its **mRNA-1273 vaccine** by the end of 2020 if at least 70% success is achieved at the trial.
- **Serum Institute of India** reported that 100 million doses of **Covishield** (Indian version of **AstraZeneca-Oxford ChAdOx1** vaccine) was expected to be available in December last year.
- **Sputnik-V** vaccine had already arrived in India and its 2/3 phase trial began soon in November last year with the claim of 92% shield against Covid-19 after halting the trials over safety matters in October.
- **Johnson and Johnson** has joined hands with US government and has poured another \$604 million for its single-shot **JNJ-78436735** vaccine. They were into the third phase of clinical trial and were hopeful to bring it on in January this year.⁸

DISCUSSION

How viable vaccines would be, While we are nearing the advent of vaccines within a few months as is expected, there are some issues that should be kept in mind about those vaccines.

- According to **Peter Doshi, Assistant Professor of Pharmaceutical Health Services at the University of Maryland**, the **third phase clinical trial** of the vaccines have **limited capacity** to ward off Covid-19 infection, mostly effective against one or two mild symptoms like cough, fever or diarrhea and not in hospitalization or emergency life support. They have been administered to only 150-160 volunteers.
- In the opinion of **Dr. Satyajit Rath, a scientist at the National Institute of Immunology and the Indian Institute of Science Education and Research, Pune**, none of the 11 candidates at their late-phase trial and jostling to win the first-prize have released evidential data that their vaccines are capable of curing Covid-19.
- The added concern is the declaration by **WHO** that a vaccine can be termed effective with **50% efficacy** in the range of 30% to 70%, while the **FDA** (Food and Drug Administration of the United States) has also stamped on it.⁹
- According to WHO, the **efficacy of the long term effectiveness** of the Covid vaccines is still **not proven**. WHO wants to be **optimistic** about the acquired immunity of the once infected patients who have developed antibodies as well as T Lymphocytes to offer protection against Covid-19. **Global Advisory Committee on Vaccine Safety** is one such set up, which would be entrusted to ensure the safety and efficacy of the vaccines.
- **COVAX** is an initiative to safeguard all those without leaving the room for any discrimination. A provision for two billion doses of COVAX is being planned by the end of this year. **Dr. Seth Berkley, CEO of Gavi, the Vaccine Alliance**, said in September, that Covax is targeted to reach **2 billion people** towards **end-2021** worldwide in an all-inclusive and affordable manner, because, according to the **World Health Organisation, until everyone is safe, no one is safe.**

CONCLUSION

It must be kept in mind that the vaccines have limited efficacy, likely to be effective only in case of **milder symptoms**, there are risks of **side-effects** which are only evident after administering to the range of million and not only to 150 odd patients. The **Adverse Events Following Immunisation (AEFI) Surveillance programme** must be followed sincerely and the government and the research organizations should be transparent about the pros and cons of their vaccines to gain public trust and reliance.¹¹

SUGGESTIONS FOR FURTHER RESEARCH

- With Covid-19 still undergoing mutations and its multiple variants raising heads in different countries, more researches are likely to follow.
- The vaccines are at their nascent stages of development, a longer time and more widespread researches are still to go.
- It is still early to predict about the efficacy of the vaccines or if they would cause any noticeable side-effects.
- Enabling mass-access to the vaccines and in a cost-effective manner is a potential area of further study.

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