

Solidarity Clinical Trial for COVID-19 Treatment” – A Systematic Review

By

Niharika Sharma

*Dissertation submitted in partial fulfillment of the requirements of the degree
MBA Hospital and Health Management*

Academic year, 2018-2020



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CERTIFICATE BY SCHOLAR

This is to certify that the dissertation titled “**Solidarity Clinical Trial for COVID-19 Treatment**” – **A Systematic Review** and submitted by **Dr. Niharika Sharma** Enrolment No. **IIHMR-U/01/2018-20/786** under the supervision of **Dr. Arindam Das** for award of MBA in Hospital and Health Management of the university carried out during the period from **6 March 2020** to **6 June 2020** embodies my original work and has not formed the basis for the award of any degree, diploma associate ship, fellowship, titles in this or any other institute or other similar institution of higher learning.

Dr. Niharika Sharma
Signature

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The certificate is awarded to

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In recognition of having successfully completed her Internship in the department of

Human Resources and Management

and has successfully completed her Project on

"Solidarity Clinical Trial For COVID-19 Treatment"

From 6 March to 6 June 2020

Vinayvishal Health Care Private Limited

She comes across as a committed, sincere & diligent person who has a strong drive and zeal for learning

We wish her all the best for future endeavors


Dr. Shivam Gupta
H.R. Head & Consultant Psychiatrist



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ABBREVIATIONS

COVID-19	Coronavirus Disease 2019
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2
WHO	World Health Organization
UNICEF	United Nations International Children's Emergency Fund
ICMR	Indian Council of Medical Research
C-TAP	COVID-19 Technology Access Pool
MERS	Middle East Respiratory Syndrome
SARS	Severe Acute Respiratory Syndrome
FDA	Food and Drug Administration
EUA	Emergency Use Authorization
CQ and HCQ	Chloroquine and Hydroxychloroquine
HIV	Human Immunodeficiency Virus
ARDS	Acute Respiratory Distress Syndrome
PEEP	Positive End-Expiratory Pressure
NSAIDs	Non-Steroidal Anti-inflammatory Drugs
RNA	Ribonucleic Acid
mRNA	Messenger Ribonucleic Acid
TPPs	Target Product Profiles

INTRODUCTION

Coronavirus disease 2019 (COVID-19) is an infectious disease caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2). The disease was first identified in December 2019 in Wuhan, the capital of China's Hubei province, and has since spread globally, resulting in the ongoing 2019–20 coronavirus pandemic.⁽¹⁾

The official names COVID-19 were issued by the WHO on 11 February 2020. WHO chief Tedros Adhanom Ghebreyesus explained: CO for corona, VI for virus, D for disease and 19 for when the outbreak was first identified (31 December 2019).⁽²⁾ UN World Health Organization (WHO) Director-General Tedros Adhanom Ghebreyesus explained that because multiple small trials of the coronavirus vaccine with different methodologies may not provide the evidence needed, WHO and partners are organizing a study to compare untested treatments throughout several countries. “This large, international study is designed to generate the robust data we need to show which treatments are the most effective”, said the WHO chief. “We have called this study the **SOLIDARITY Trial**”.⁽³⁾

To increase the chances of success, WHO is facilitating interactions between scientists, developers and funders to support coordination, and/or provide common platforms for working together.⁽⁴⁾ Solidarity Clinical Trial was announced on 18th March 2020, is a global multi country drug trial to find a treatment for the Novel Coronavirus Disease (COVID2019).⁽¹⁾ It is combining the relative strengths of different stakeholders. It has used its global mandate to rapidly convene 300 scientists, developers and funders to increase the likelihood that one or more safe and effective vaccines will soon be available to all.⁽⁴⁾ The trial will not only test four different drugs or combinations but will also compare their effectiveness.

The Solidarity Trial will compare four treatment options against standard of care, to assess their relative effectiveness against COVID-19. By enrolling patients in multiple countries, the Solidarity Trial aims to rapidly discover whether any of the drugs slow disease progression or improve survival. Other drugs can be added based on emerging evidence.⁽¹⁾

The availability of a safe and effective vaccine for COVID-19 is well-recognized as an additional tool to contribute to the control of the pandemic. At the same time, the challenges and efforts needed to rapidly develop, evaluate and produce this at scale are enormous. It is vital that we evaluate as many vaccines as possible as we cannot predict how many will turn out to be viable.⁽⁴⁾

To guide the efforts of vaccine developers, WHO has drawn up a Global Target Product Profile target product profiles (TPPs) for COVID-19. The TPPs cover two types of vaccines: vaccines for the long-term protection of people at higher risk of COVID-19 such as healthcare workers; and vaccines for use in response to outbreaks with rapid onset of immunity. Once a safe and effective vaccine becomes available, it will be vital that it is accessible to everyone who needs it.⁽⁵⁾

On 3 April, WHO and UNICEF announced an agreement to work together on COVID-19 response, through the historic COVID-19 Solidarity Response Fund powered by the United Nations Foundation and Swiss Philanthropy Foundation to facilitate an unprecedented global response by supporting the WHO Strategic Preparedness and Response Plan.⁽⁶⁾

On 13 May 2020, the Indian Council of Medical Research (ICMR) has fast-tracked the roll out of global 'Solidarity' trial launched by the World Health Organisation (WHO), to help find an effective treatment for COVID-19.⁽⁷⁾

On 29 May, thirty countries and multiple international partners and institutions have signed up to support the COVID-19 Technology Access Pool (C-TAP) an initiative aimed at making vaccines, tests, treatments and other health technologies to fight COVID-19 accessible to all. The Pool was first proposed in March by President Carlos Alvarado of Costa Rica. There are five key elements to the initiative:

- public disclosure of gene sequencing research;
- public disclosure of all clinical trial results;
- encouraging governments and research funders to include clauses in contracts with pharmaceutical companies about equitable distribution and publication of trial data;
- licensing treatments and vaccines to large and small producers;
- promoting open innovation models and technology transfer that increase local manufacturing and supply capacity.⁽⁸⁾

The COVID-19 pandemic has revealed the fallibility of traditional ways of working when it comes to equitable access to essential health technologies. This initiative sets out an alternative, in line with WHO's efforts to promote global public health goods, based on equity, strong science, open collaboration and global solidarity. Now more than ever, international cooperation and solidarity are vital to restoring global health security, now and for the future.⁽⁹⁾

METHODOLOGY

I have conducted a systematic review to summarize and critically analyse all the published scientific articles regarding the COVID-19. This review aims to provide the evidence on the effective treatment and the availability of vaccine of COVID-19. This will provide meaningful information for future research related to this topic and may support government decision-making on strategies to handle this public health emergency at the community, national, and international levels.

RATIONALE

To deal with COVID-19, WHO considered the need for speed and scale in the trial. The solidarity trial will help to reduce the time taken by 80%. This will help to facilitate the rapid worldwide comparison of unproven treatments and will overcome the risk of multiple small trials which not generate the strong evidence needed to determine the relative effectiveness of potential treatments. ([who, Solidarity" clinical trial for COVID-19 treatments, 2020](#))

RESEARCH QUESTION

How effective is the solidarity clinical trial for COVID-19?

OBJECTIVES

- To understand the solidarity trial.
- To know the available treatment of COVID-19 and compare their effectiveness against COVID-19.
- To know the availability of safe and effective vaccine for COVID-19.

PARTICIPATION IN SOLIDARITY

Over 400 hospitals in 35 countries are actively recruiting patients and nearly 3500 patients have been enrolled from 17 countries. Overall, over 100 countries have joined or expressed an interest in joining the trial, and WHO is actively supporting 60 of them with:

- ethical and regulatory approvals of the WHO core protocol;
- identification of hospitals participating in the trial;
- training of hospital clinicians on the web-based randomization and data system;
- shipping the trial drugs as requested by each participating country.

The greater the number of participating countries, the faster results will be generated. WHO is facilitating access to thousands of treatment courses for the trial through donations from several manufacturers. WHO is also inviting developers and companies to collaborate on ensuring affordability and availability of the treatment options if they prove effective.⁽¹⁾

TABLE 1: The Four Treatment Options Against Standard Of Care, To Assess Their Relative Effectiveness Against COVID-19:

Remdesivir	Chloroquine and Hydroxychloroquine	Lopinavir and Ritonavir	Interferon-β in combination with Lopinavir and Ritonavir
Manufactured in 2014 to treat Ebola, by US-based biotechnology firm Gilead Sciences Inc., it has since been used to treat for MERS and SARS.⁽¹⁰⁾ In phase three clinical trial of Remdesivir, hospitalized patients with advanced COVID-19 and lung involvement recovered 50 percent faster than similar patients who received placebo and more than half were discharged from	These 2 generic drugs are used to treat malaria and rheumatology conditions.⁽¹⁶⁾ The HCQ and CQ have demonstrated antiviral activity against severe acute respiratory syndrome–SARS–CoV-2.⁽¹⁶⁾ Hydroxychloroquine and chloroquine are accepted as generally safe for use in patients with autoimmune diseases or malaria,⁽¹⁾ also has the capability of	The combination of lopinavir and ritonavir (brand name- Kaletra) is a licensed treatment for HIV.⁽¹⁸⁾ Ritonavir and Lopinavir drug combination is India's drug combination of choice against COVID - 19 after two patients in Jaipur recovered from the disease after their administration. One of them, however died later of a cardiac	Interferon beta-1a is used to treat multiple sclerosis.⁽²⁾ This drug combination was shown to have an effect in an animal model of MERS. Interferon is a cytokine that is produced by our own bodies as part of the immune response against an invading virus or bacteria. As some COVID-19 patients have a cytokine storm that causes

the hospital within two weeks, according to a preliminary data analysis from a randomized, controlled trial involving 1063 patients, which began on February 21. (11), (12) The US FDA has granted EUA for the experimental anti-viral drug Remdesivir to treat COVID-19 on 2 May 2020. (13) NIAID director Fauci, an immunologist and a member of the US task force against COVID-19, told the media in the White House: “The data shows that Remdesivir has a clear cut, significant, positive effect in diminishing the time to recover. Although a 31 per cent improvement does not seem like a knockout 100 per cent, it is a very important proof of concept. What it is proving is that a drug can block this virus.” (14) US drug-maker Gilead Sciences had signed	inhibiting the replication of several intracellular micro-organisms including coronaviruses in vitro. (17) India has become the biggest supplier of the HCQ and has fulfilled large orders from countries such as the US, UAE and UK. (17) “There have been reports of some patients developing cardiac arrhythmias due to HCQ which can cause sudden cardiac death” said Dr. M C Mishra, former director of the AIIMS in Delhi and one of the India’s top surgeons. (17)	arrest. (18), (19) The lopinavir-ritonavir trial started when there were only 500 COVID-19 cases worldwide. (10) There is currently no strong evidence for the efficacy of lopinavir/ritonavir in the treatment of COVID-19. (19), (10)	their lungs to fill with fluid, requiring them to be ventilated, a drug like interferon-beta can help to “calm” this storm and prevent the need for ventilation. (2) UK-based Synairgen began the Phase II and III trials of SNG001, a special inhalation formulation of interferon beta-1a in patients with COVID-19. (20)
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agreements allow the companies – Cipla, Hetero Labs, Jubilant Lifesciences, Mylan and Pakistan-based Ferozsons Laboratories, to manufacture remdesivir for distribution in 127 countries. (15)	However, on 25 May the Executive Group of the trial has implemented a temporary pause of the hydroxychloroquine arm within the Solidarity Trial while the safety data is reviewed by the Data Safety Monitoring Board. (1)	Studies are still ongoing, and there's still a possibility this combination could show some benefit. As with other antivirals, this drug would likely work better if given earlier in the disease course. (18) , (9)	For this drug combination, the trial is ongoing to know its effectiveness to treat COVID-19. (20)
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HOW THE SOLIDARITY TRIAL WORKS

Adults (age ≥ 18 years) with COVID-19 admitted to participant hospitals can join this study. Eligible patients will be asked to sign to show they understand the possible risks and benefits and consent to joining the study. The medical team responsible for each patient will check whether any of the study treatments would be unsuitable.

After those checks, brief identifying details and any other conditions are digitally recorded for the patient, who is then randomly allocated to one of the study options:

- Local standard of care, Or local standard of care plus one of the following;
 - i. Remdesivir
 - ii. Chloroquine or Hydroxychloroquine
 - iii. Lopinavir with Ritonavir
 - iv. Lopinavir with Ritonavir plus Interferon beta-1a.

This may or may not involve one of the study treatments. Neither the patient nor the medical staff choose which of the study options a patient will receive, as a computer makes this allocation at random.

Critical anonymized information for the trial will only be collected at the randomization stage and when the patient is discharged or dies: which study drugs were given (and for how many days); whether ventilation or intensive care was received (and, if so, when it began), date of discharge, or date and cause of death while still in hospital.

Interim trial analyses are monitored by a Global Data and Safety Monitoring Committee, which is an independent group of experts.

Underlying conditions recorded are diabetes, heart disease, chronic lung disease, chronic liver disease and asthma, extending to HIV and tuberculosis in the African region.

Severity of illness at entry is determined by recording: shortness of breath, being given oxygen, already on a ventilator, and, if lungs imaged, major bilateral abnormality. [\(10\)](#)

WHAT OTHER TREATMENTS ARE AVAILABLE?

There is currently no treatment specifically approved for COVID-19, and no cure for an infection, although treatments and vaccines are currently under study. Instead, treatment focuses on managing symptoms as the virus runs its course. [\(1\)](#)

In some cases, experimental treatments are tested to see how effective they are.

Examples of therapies used for these illnesses include:

Antiviral or Retroviral medications: Research into potential treatments started in January 2020, and several antiviral drugs (like Darunavir, Favipiravir, Oseltamivir, xianping) are in clinical trials. Antiviral medication may be tried in people with severe disease. The WHO recommended volunteers take part in trials of the effectiveness and safety of potential treatments. [\(21\)](#), [\(22\)](#)

Breathing support, such as Mechanical Ventilation: Most cases of COVID-19 are not severe enough to require mechanical ventilation or alternatives, but some of the cases are. Mechanical ventilation becomes more complex as acute respiratory distress syndrome (ARDS) develops in COVID-19 and oxygenation becomes increasingly difficult. Ventilators capable of pressure control modes and high PEEP are needed to maximise oxygen delivery while minimising the risk of ventilator-associated lung injury and pneumothorax. [\(22\)](#)

Steroids to reduce lung swelling: The WHO and NIH do not oppose the use of non-steroidal anti-inflammatory drugs (NSAIDs) such as ibuprofen for symptoms, and the FDA says currently there is no evidence that NSAIDs worsen COVID-19 symptoms. Steroids, such as methylprednisolone, are not recommended unless the disease is complicated by acute respiratory distress syndrome. [\(22\)](#)

Blood plasma transfusions: The convalescent plasma therapy aims at using antibodies from the blood of a recovered COVID-19 patient to treat those critically affected by the virus. The therapy can also use to immunise those at a high risk of contracting the virus such as health workers, families of patients and other high-risk contacts.

Once the patient has recovered, they can donate their blood so that their antibodies can be used to treat other patients. The donated blood is then checked for the presence of any other disease-causing agents such as Hepatitis B, Hepatitis C, HIV etc. If deemed safe, the blood is then taken through a process to extract 'plasma', the liquid part of the blood that contains antibodies. The antibody-rich plasma, once extracted, is then ingested into the body of a patient under treatment.

John Hopkins University immunologist Arturo Casadevall, who is spearheading a project to use the therapy, has said, "The concept is simple. Patients who recover from an infectious disease often produce antibodies that can protect against later infections with the same microbe. This immunity can be transferred by giving serum to those at risk of infection." [\(23\)](#)

Plasma therapy's potential as treatment for COVID-19 has already been explored in limited trial in China, where the outbreak first emerged. The trial showed some improvement in patients' condition. Now, several countries, including

India, are seriously looking at plasma therapy as a potential treatment for COVID-19. ⁽²⁴⁾

VACCINE FOR COVID - 19:

For COVID-19, there are over 120 vaccines being developed across the world now, some from scratch, some from existing molecules developed for other diseases. ⁽²⁵⁾ There are currently more than 110 teams in contention, speeding up efforts to produce a ready vaccine. Some have reached the clinical trial stage; others have shown a little less than favourable results.

A vaccine would normally take years, if not decades, to develop. But in this case, researchers hope to achieve the same amount of work in just a few months. Most experts think a vaccine is likely to become available by mid-2021. ⁽²⁶⁾ Leading researchers are still saying that it can be another 14-18 months before the world gets to access a vaccine. The same is the case with Indian vaccine, as experts say that it is still in the nascent stage and it will take a while before we see conclusive development. ⁽²⁵⁾ A lot of vaccines are in the development phase in India as well, and medicinal trials are also going on for treatment. The reason behind the rush is a staggering number of COVID-19 cases and the death toll daily. ⁽²⁶⁾

As of May 24, there were at least 10 vaccines in human trials, according to the World Health Organization (WHO): ⁽²⁶⁾

Moderna's RNA vaccine:

The Massachusetts-based biotech company Modern Inc. among the top front-runners in the race to develop an RNA-based vaccine, which is being called mRNA-1273. The company has already successfully completed phase 1 trials of its vaccine candidate. It was given the go-ahead by the FDA to begin the phase 2 trial and is all set to conduct it on 600 healthy individuals in the month of July. While the development was expedited by the FDA, preliminary data suggest that the vaccine largely benefitted the candidates who participated in phase 1 of the clinical trials. Tal Zaks, Moderna chief medical officer, told The Financial Times that the results showed that even lower doses elicited an “immune response of the magnitude caused by natural infection”. “These data substantiate our belief that mRNA-1273 has the potential to prevent COVID-19 disease,” he said. According to a current report filed by Moderna with the US Securities and Exchange Commission, a “...commercially-available vaccine is not likely to be available for at least 12-18 months, it is possible that under emergency use, a vaccine could be available to some people, possibly including healthcare professionals, in the fall of 2020”. ⁽²⁷⁾

Pfizer-BNTECH vaccine:

The pharmaceutical giant, which is co-producing the vaccine with the help of a German company, BNTECH has started the process of dosing patients. Four vaccine candidates devised out of messenger RNA (mRNA) format are being tested on volunteers to identify the most viable and suited vaccine of the four. The data is being shared with scientists in real-time. The tests are currently going on in Germany and parts of the USA. ⁽²⁶⁾

On 29 May Pfizer believes that a COVID-19 vaccine could be ready by the end of October 2020, reported The Times of Israel, citing Albert Bourla, the CEO of the

firm. Pfizer is working with German firm BNTECH for several possible vaccines in Europe and the United States.⁽²⁸⁾

Oxford University and AstraZeneca Plc vaccine:

The collaboration between the University of Oxford and pharma giant, AstraZeneca Plc's experimental vaccine 'ChAdOx1 nCoV-19' was highly looked forward to ever since the trials began in April. The study is set to move into the second phase of clinical trials, where over 10,200 people between the ages of 5-12 and those over 70 will be enrolled. Post that, plans of involving people over the age of 18 have at a wide scale have been reported.

Researchers said clinical trials are progressing very well and they are now initiating studies to see how well the vaccine induces immune responses in older adults. The studies will also assess whether the vaccine can provide protection in the wider population. Oxford scientists said a million doses of their COVID-19 vaccine could be ready as early as September. The vaccine project is being run by the Jenner Institute and Oxford Vaccine Group.⁽²⁹⁾

CanSino Biologics Inc and Beijing Institute of Biotechnology vaccine:

CanSino Biologics Inc. is working in collaboration with the Beijing Institute of Biotechnology from China also proceed to the stage 2 of the study. In the testing done so far, participants who received a single dose of the vaccine produced certain immune cells, called T cells, within two weeks while the antibodies needed for immunity peaked at 28 days. CanSino makes its vaccine using a genetically modified cold-causing virus to carry the genetic material of the novel coronavirus, similar to the approach employed by Oxford.⁽²⁶⁾

Wuhan Institute of Biological Products/Sinopharm:

Wuhan Institute of Biological Products, part of state-owned China National Pharmaceutical Group (Sinopharm Group) and the Wuhan Institute of Virology, part of the Chinese Academy of Sciences, had advanced their COVID-19 vaccine candidate to a Phase II trial. They are developing an inactivated vaccine using non-living viruses, bacteria or other pathogens that have lost disease-producing capacity to stimulate the immune system to develop an immune response.⁽³⁰⁾

Beijing Institute of Biological Products/Sinopharm:

Sinopharm, and the Beijing Institute of Biological Products had entered Phase II clinical trials. They are developing an inactivated vaccine.⁽³⁰⁾ A vaccine could be ready for the market as early as the end of this year or early 2021, according to the May 29 post on Chinese social media platform WeChat.⁽³¹⁾

Sinovac:

Chinese biopharmaceutical products company Sinovac Biotech started developing the inactivated vaccine against COVID-19 in January this year in collaboration with academic research institutes in China. On 31 May as per a Sky News report, Luo Baishan, a researcher at Sinovac, said, "It must be successful...99 per cent sure." The company has reached stage 2 of its vaccine trial, with more than 1000 volunteers

participating. The company is in preliminary talks to hold stage 3 trials – the final part of the process in the UK. [\(32\)](#), [\(33\)](#)

Novavax Covid 19 vaccine:

Named NVX-CoV2373, Novavax's vaccine is created using recombinant protein nanoparticle technology — a genetic-engineering technology. On May 25, the US-based vaccine development company announced in a press release that it had begun Phase I/II trial of its COVID-19 vaccine candidate in Australia. The preliminary results of Phase-1 trial are expected in July 2020, after which Phase-II trials will begin in multiple countries, including the US. In the meantime, Novavax has bought Czech Republic-based Praha Vaccines, a unit of India's Cyrus Poonawalla Group, which also owns Serum Institute, in Pune. [\(26\)](#)

Institute of Medical Biology, Chinese Academy of Medical Sciences:

They are developing the inactivated vaccine against COVID-19. Currently they are in the phase 1 trial of clinical evaluation. [\(26\)](#)

Inovio Pharmaceuticals:

Inovio Pharmaceuticals has reported promising data from the preclinical studies of its COVID-19 vaccine candidate, INO-480, in mice and guinea pigs. The company expects to report preliminary safety and immune responses data from a Phase I clinical trial in June. Furthermore, a Phase II/III efficacy trial has been planned for launch in July/August, pending regulatory approval. [\(34\)](#)

CONCLUSION

Solidarity Trial is a large international clinical trial to help find an effective treatment for COVID-19, launched by the WHO and partners.

Till now as per the WHO, there is no specific treatment for COVID-19. To manage the patients WHO recommended four treatment options against standard of care: Remdesivir, Chloroquine and Hydroxychloroquine, Liponavir/Ritonavir, and Liponavir/Ritonavir combined with interferon beta.

The antiviral drug Remdesivir shows some positive result, it reduced the duration of recovery by 4 days. The phase 3 clinical trial of Remdesivir is started, said to be the final step in the process of the drug approval. However, WHO temporary pause the use of Hydroxychloroquine within the solidarity trial on 25 May while the safety data is reviewed by the Data Safety Monitoring Board. For Lopinavir/Ritonavir and their combination with Interferon- β , the trial is ongoing and there is currently no strong evidence to prove their efficacy to treat COVID-19.

Patients are also managing with Antiviral or Retroviral medications, Mechanical ventilation, Steroids and Blood plasma transfusions. The convalescent plasma therapy showed some improvement in patients' condition. Now, several countries are seriously looking at plasma therapy as a potential treatment for COVID-19 including India, where this therapy was first used for coronavirus patients on 21 April 2020 in Max Hospital, Saket.

The virus spreads easily and most of the world's population is still vulnerable to it. A vaccine would provide some protection by training people's immune systems to fight the virus so they should not become sick. The reason behind the rush is a staggering

number of COVID-19 cases (6,229,895) and death toll (372,888) globally, in India alone, there are 151,876 corona cases as of May 31. The development of a vaccine would allow lockdowns to be lifted more safely, and social distancing to be relaxed. For COVID-19, there are over 120 vaccines being developed across the world now in which at least 10 vaccines in human trials as per WHO included Moderna's RNA vaccine, Pfizer-BNTECH vaccine, Oxford University and AstraZeneca Plc vaccine, Novavax COVID 19 vaccine, Inovio Pharmaceuticals, and five china-based vaccines: CanSino Biologics Inc and Beijing Institute of Biotechnology vaccine, Wuhan Institute of Biological Products/Sinopharm, Beijing Institute of Biological Products/Sinopharm, Sinovac, Institute of Medical Biology, Chinese Academy of Medical Sciences.

In India, more than 30 vaccine candidates are in various stages of development to fight the novel coronavirus of which 20 are keeping a good pace. The WHO has listed Serum Institute of India, Zydus Cadila, Indian Immunologicals Limited and Bharat Biotech from India among the firms involved in developing a vaccine for COVID-19.

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