

# Corona Virus from Symptoms to Corona Treatment

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## Abstract

Single-stranded RNA's have been causing respiratory diseases for many years. At the end of 2019, a novel coronavirus was identified as the cause of a cluster of pneumonia cases in Wuhan of China. Since the first reports of cases from Wuhan, cases have been reported in all continents. COVID-19 has seen several mutations to date; the biggest challenges created by the four corona mutation are alpha, beta, gamma and delta. Clinical presentation varies from asymptomatic, subclinical infection and mild illness to severe or fatal illness; deterioration can occur rapidly, often during the second week of illness. Management of the complications of COVID-19 relies on supportive care and oxygen supplementation via non-invasive or mechanical ventilation. Patients who are critically ill may require vasopressor support and antibiotics for secondary bacterial infections. Vaccines are being developed using a diverse range of delivery platforms, including DNA and RNA, self-amplifying RNA, virus-like particle, peptide, viral vector, recombinant protein, live attenuated virus and inactivated virus. The purpose of writing this article is to explain the history of diseases caused by single-stranded RNA's and to examine the structure of the COVID-19 virus and the symptoms of the disease caused by this virus and possible treatment methods and vaccines.

**Keywords:** COVID-19 • Open Reading Frames (ORF) • Disease • RNA • DNA

## Introduction

There are large group of single-stranded positive sense RNA's that they infect a wide variety of animal's including: human's, birds, rodents, carnivores, chiropters and other mammals with corona virus [1,2].

These RNA's have a diameter of 60 to 140 nm and they have protrusions on their surfaces and they can be seen under a microscope, due to the presence of these crown like protrusions on the surface of the virus, they became known as coronavirus [3].

Coronaviruses cause acute respiratory syndrome or pneumonia, the clinical symptoms of that, it's different for each person. In some people it is asymptomatic and in others, depending on the type of immune system of their bodies, the symptoms of the virus can be mild to severe. Symptoms may include a sore throat and body aches and in severe cases, fever, cough and severe respiratory distress [4-6].

Single-stranded RNA's have been causing respiratory diseases for many years, but in December 2019 they introduced themselves to the human community with new characteristics and caused a new disease that leads to respiratory tract infections and eventually they caused the death of a large number of people and therefore attracted the attention of all countries and the alarm of the world health organization was sounded and the warning of this virus with the concept of COVID-19 was given to all countries of the world [7-10].

COVID-19 has seen several mutations to date but the death toll in some countries has been higher than in others, countries that have suffered many casualties, the United states, Brazil, India, Mexico, Italy, the United kingdom, France, Iran, Russia and Spain where from December 2019 to December 2020, more than 50, 000 deaths from the virus and more than 74 million according to these statistics, the virus has affected the whole world and has led to the collapse of health system and major economic changes [11].

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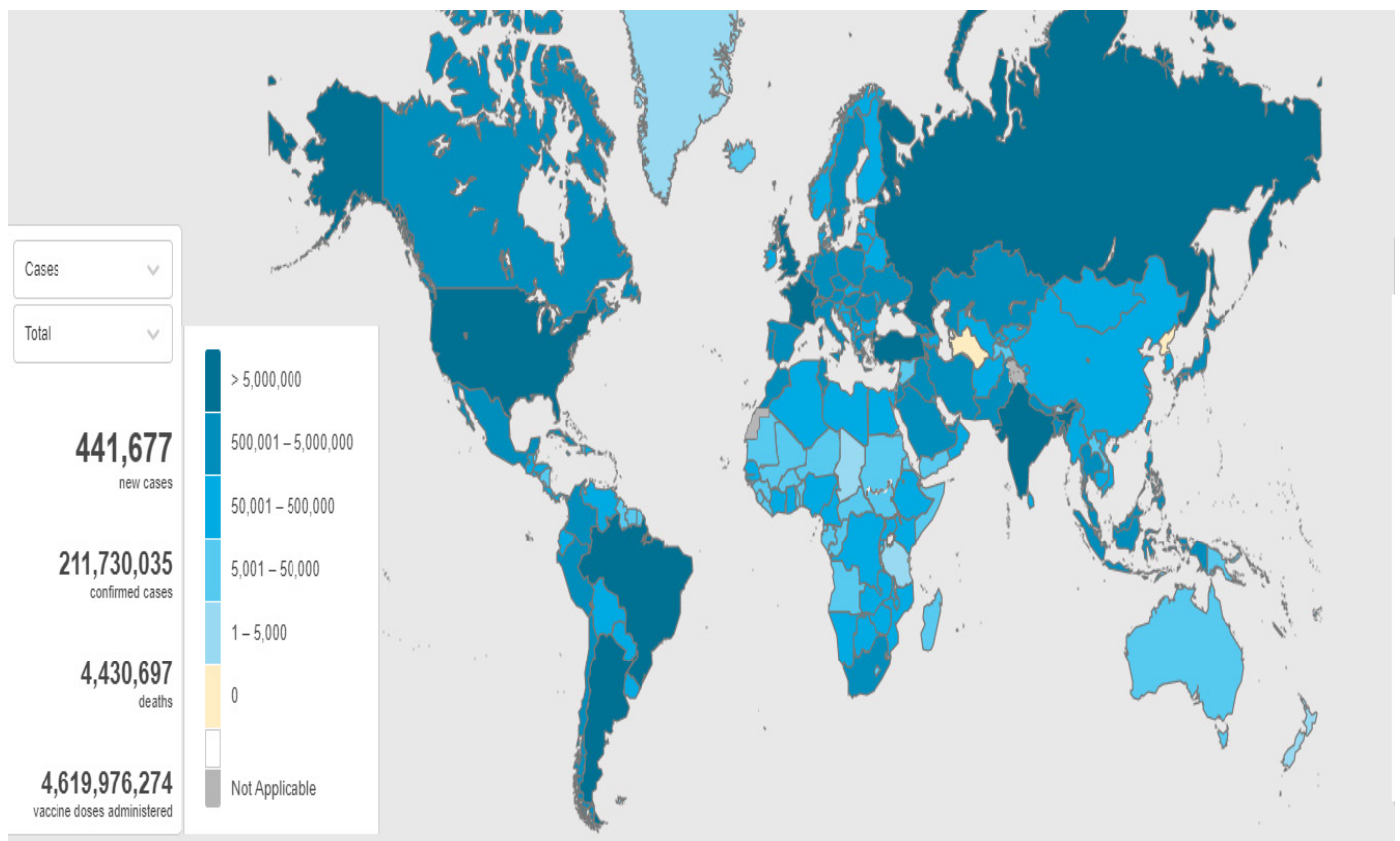
It is thought that in the future due to increased human interaction we will need an effective and definitive treatment to combat this deadly virus but now there is no definitive treatment for this disease and the best way is prevention [12].

## History of Corona virus related to sickness of humans

Single-stranded RNA's that lead to pathogenicity in humans were first reported in two different strains in the mid-1960s, after which seven different strains of the virus were discovered, only three of which caused pathogenicity in humans, they were the source of all three bats, causing acute respiratory syndrome [13,14]. It first appeared as acute respiratory syndrome in southern china in Guangdong province in 2002 and was recognized worldwide as a pandemic human disease that killed many people. In July 2003, the world health organization announced the end of the disease [15]. In June 2012 another similar disease appeared in Saudi Arabia, known as Merc COVID which spread to a group of people in the Middle East who had traveled and killed 858 people [16,17]. Bats are the main cause of these viruses, and there are many theories that camels and cats are the middle hosts, meaning that these organisms transmit the disease from bats to human [14,18]. In 2019 a serious catastrophe was reported in the Republic of China that spread around the world in two months [19,20]. The virus is of animal origin and has a high potential for infection [21]. After extensive research, seafood markets (Huanan south china) were identified as the source of infection for this virus, but it was found that they were the main hosts of bats [22]. The international Committee for the Classification of viruses named it SARS COVID 2 because of its resemblance to the virus that broke out in 2003 and on March 11, 2020, it was declared a global pandemic [23,24].

## Epidemiology

In late December 2019, Chinese officials notified the World Health Organization (WHO) of an outbreak of pneumonia-like symptoms in Wuhan, China. Since then, the corona virus has spread to the point where people infected with the corona virus have been seen around the world, and finally on March 11, 2020, the World Health Organization declared the corona virus an epidemic. Since then about 212,357,898 million people have been affected of COVID-19, including 4,439, 843 deaths. A total of 4,619, 976,274 vaccine doses have been administered ([https:// COVID19.who.int/assed](https://COVID19.who.int/assed)) on 24 August 2021 (Figure 1). The United States (37,588,597 million), India (32,477,773), Brazil (20,570,891), Russia (6,785,374), the United Kingdom (6,524,585), France (6, 488, 376), Turkey (6,234,520), Argentina (5,133,831), Colombia (4,889,537), Spain (4,794,352), Iran (4,715,771) and Italy (4,488,779) have reported the



**Figure 1.** Worldwide COVID19 confirmed cases and deaths adapted from WHO (<https://covid19.who.int/assessed> on 24 August 2021).

highest rates of infection to the World Health Organization, respectively (<https://COVID19.who.int/assessed> on 24 August 2021). The highest mortality rates from the virus, according to the World Health Organization, belong to in the United States (623,900), Brazil (574,527), India (435,110), Mexico (253,155), Peru (198,879), Russia (177,614), the United Kingdom (131,680), Italy (128,795) and Indonesia (128,752), respectively (<https://COVID19.who.int/assessed> on 24 August 2021).

### Genomic features

According to NCBI database (accession number NC\_045512.2) coronavirus single-stranded positive sense RNA, *s* is around ~30 kb (29903 base) consist of 5' untranslated regions (5' UTR), twelve putative functional open reading frames (ORFs): ORF1a, ORF1b, ORF3a, ORF 4 (E), ORF5, ORF6, ORF7a, ORF7b, ORF8, ORF9 (N) and 3' untranslated regions (3' UTR). There are four structural protein: spike glycoprotein (S protein), Envelope protein (E protein), nucleocapsid phosphoprotein (N protein) and membrane protein (M protein) which is encoded by ORF1ab, ORF 4, ORF9 and ORF5 respectively. There are sixteen putative nonstructural protein (nsp) including nsp1 (Leader protein), nsp2, nsp3, nsp4, nsp5 (3C-like proteinase), nsp6, nsp7, nsp8, nsp9, nsp10, nsp11, helicase, exonuclease, methyltransferase, protease, RNA polymerase which are involved in replication, transcription of COVID19 virus (Table 1) [6,25].

All viruses have a feature called mutation, which is produced over time and their genetic code changes. Corona, like all other viruses, has different mutations, which are called mutant viruses. Different subgroups of coronavirus have been reported to WHO (Tables 2-4) (<https://COVID19.who.int/assessed> on 24 August 2021). The subgroups of the coronavirus family are alpha ( $\alpha$ ), beta ( $\beta$ ), gamma ( $\gamma$ ), delta ( $\delta$ ), Eta ( $\eta$ ), Iota ( $\iota$ ), Kappa ( $\kappa$ ) and Lambda ( $\lambda$ ) of the coronavirus. The biggest challenges created by the four corona mutation are alpha, beta, gamma and delta. But the Delta mutation became more prevalent than the other mutations and attracted more of attentions This strain was declared 60% more contagious than alpha, The peak of this epidemic occurred in India, which was very deadly and over time spread to other countries, The symptoms of this type are different from the previous ones, so that it can be

confused with a simple cold and the person with the disease can transmit his disease to a large number of people [26].

## Materials and Methods

### Symptoms and treatments

COVID-19 disease can be dangerous at any ages, the infection can be transmitted from a carrier to a healthy person through cough drops and sneezes [27]. The amount of virus in the nasal cavity and throat of a person who has symptoms is the same as that of a person who is a carrier of virus and has no symptoms and there is no difference [27]. A person who has no clinical symptoms but is a carrier of the disease can infect a large number of people with the virus in contact with healthy people [28,29]. An infected person when coughing or sneezing can spread many droplets that carry large numbers of the virus from one to two meters [29]. A healthy person becomes infected by inhaling these droplets and the virus can also be transmitted from the feces of an infected person [30]. Transmission of the disease from a coronated mother to her fetus has not been reported but the important thing is that babies can be infected with the virus after birth [31]. The incubation period of the disease varies from 2 to 14 days and the angiotensin receptor is known as the receptor to which the virus attaches and through which it can enter the respiratory mucosa [32,33]. COVID-19 disease varies based on a variety of factors including age, gender, immune system resistance and health living conditions [34]. On average one person in 5 people with the disease is at risk for a severe infection and those over the age of 50 to 60 are at higher risk for the disease [34]. The effect of COVID-19 on one person's body varies from person to person, depending on the immune system, age group and the amount of virus entering the body [35]. People with an older age or a weekend immune system, such as people with HIV or people with a variety of cancers, are less resistant to the disease than other people and the symptoms of the disease are more acute [36]. The clinical symptoms of this disease may be mild such as a headache and fatigue to more severe symptoms such as fever, sore throat, gastrointestinal pain and etc. [37-40]. When the disease reaches the lungs, the infection affects the lungs, causing the cytokines to become too

**Table 1.** Genomic features.

Components	Open Reading Frames	
Gene	1-29903	
5'UTR	1-265	
CDS	266-13468,13468-21555	ORF1ab
Spike glycoprotein"	21563-25384	ORF1ab
ORF1ab polyprotein"	266-21555	ORF1ab
Leader protein	266-805	ORF1ab
nsp2	806-2719	ORF1ab
nsp3	2720-8554	ORF1ab
nsp4	8555-10054	ORF1ab
3C-like proteinase	10055-10972	ORF1ab
nsp6	10973-11842	ORF1ab
nsp7	11843-12091	ORF1ab
Nsp8	12092-12685	ORF1ab
Nsp9	12686-13024	ORF1ab
nsp10	13025-13441	ORF1ab
nsp11	13442-13480	ORF1ab
helicase	16237-18039	ORF1ab
ORF1a polyprotein	266-13483	ORF1ab
3'-to-5' exonuclease	18040-19620	ORF1ab
endoRNAse	19621-20658	ORF1ab
2'-O-ribose methyl transferase	20659-21552	ORF1ab
CDS	25393-26220	ORF3a
Envelope(E) protein	26245-26472	ORF4
Membrane glycoprotein	26523-27191	ORF5
ORF6 protein	27202-27387	ORF6
ORF7a protein	27394-27759	ORF7a
ORF7b	27756-27887	ORF7b
ORF8 protein	27894-28259	ORF8
Nucleocapsid phosphoprotein	28274-29533	ORF9
ORF10 protein	29558-29674	ORF10

**Table 2.** Different variants of coronavirus adapted from WHO dashboard on 24 August 2021.

WHO LABEL	Pango Lineages	GISAID Clade	Nextstrain Clade	Additional Amino Acid Changes Monitored	Earliest Documented Samples	Date of Designation
Alpha	B.1.1.7	GRY	20I (V1)	+S:484K +S:452R	United Kingdom, Sep-2020	18-Dec-2020
Beta	B.1.351 B.1.351.2 B.1.351.3	GH/501Y.V2	20H (V2)	+S:L18F	South Africa, May-20	18-Dec-2020
Gamma	P.1 P.1.1 P.1.2 P.1.4 P.1.6 P.1.7	GR/501Y.V3	20J (V3)	+S:681H	Brazil, Nov-20	11-Jan-21
Delta	B.1.617.2 AY.1 AY.2 AY.3 AY.3.1	G/478K.V1	21A	+S:417N	India, Oct-20	VOI: 4-Apr-2021 VOC: 11-May-2021

high at the location, releasing signals that cause large amounts of immune cells to be absorbed at the site of infection. Excessive increase in cytokines and immune cells in the lungs causes the thin walls of the lungs to thicken, resulting in acute respiratory problems and even death. [41,42].

Severe damage and loss of lung tissue causes disruption of oxygen delivery to various organs of the body such as kidneys, liver, brain, etc. and patient needs oxygen devices to breathe and survive [42].

In some people, this disease causes simultaneous disorders of several organs and in some cases, heart failure, severe kidney damage, etc. have been observed [39,40,43].

People suspected of having COVID-19 should be notified immediately if they are actually infected with the virus, in order to be able to isolate themselves quickly and receive appropriate treatment, the diagnosis is usually made by radiography which is a radiation to the chest [20,44,45].

A person with COVID-19 has symptoms such as fever, sore throat, cough, etc. but another person can have a positive molecular test without any suspicious symptoms. Specialized molecular tests on respiratory specimens include : (throat swab, nasopharyngeal swab /sputum, endotracheal aspirates and Broncho alveolar lavage ) if the virus is high in the body, it can be found in the stool and in very acute cases, the infection can be seen in a blood test [45]. The disease can be transmitted from a person who is in the incubation

**Table 3.** Different variants of coronavirus adapted from WHO dashboard on 24 August 2021.

WHO LABEL	Pango Lineages	GISAID Clade	Nextstrain Clade	Earliest Documented Samples	Date of Designation
Eta	B.1. 525	G/484K.V3	21D	Multiple Countries, Dec-2020	17-Mar-2021
Lota	B.1.526	GH/253G.V1	21F	United States of America, Nov-2020	24-Mar-2021
Kappa	B.1.617.1	G/452R.V3	21B	India, Oct-2020	4-Apr-21
Lambda	C.37	GR/452Q.V1	21G	Peru, Dec-2020	14-Jun-21

**Table 4.** Different kind of vaccine developed due to the COVID-19 pandemic.

Manufacturer	Name of Vaccine	Platform	Status of Assessment	Anticipated Decision	Efficacy
Serum Institute of India	Covishield (ChAdOx1_nCoV19)	recombinant ChAdOx1 adenoviral vector encoding the Spike protein antigen of the SARS-CoV-2	In progress	Mid Feb 2021	62%
Pfizer (Biontech)	BNT162b2/ COMIRNATY (INN: tozinameran)	Nucleoside modified mRNA	Finalized	Used	52% after first dose 95% after second dose
Moderna	mRNA-1273	mRNA-based vaccine encapsulated in lipid nanoparticle (LNP)		Estimated end of Feb 2021	94.1%
AstraZeneca (University of Oxford)	AZD1222	recombinant replication defective chimpanzee adenovirus expressing the SARS-CoV2 S surface glycoprotein	In progress Core data NonCovax. Covax data to be reviewed as EMA post approval change	Earliest by EMA End of Jan-Feb 2021 (nonCovax) Additional nodes in March/April for Covax	more than 90%
Janssen (Infectious Disease & Vaccines)	Ad26.COV2.S	recombinant, replication incompetent adenovirus type 26 (Ad26) vectored vaccine encoding the (SARS-CoV-2) Spike (S) protein	Not yet started. Use abridged procedure relying on EMA	Earliest May – June 2021	More than 90%
Sinovac	SARS-CoV-2 Vaccine (Vero Cell), Inactivated	Inactivated, produced in Vero cells	In progress	Earliest March	50.4%
Sinopharm/BIBP2	Ad26.COV2.S	Inactivated, produced in Vero cells	In progress	Earliest March	86%

period and has no clinical symptoms to a healthy person, since the onset of symptoms in each person's body is different, it is better to see each person as a carrier than we can prevent this disease [46]. Many drugs have been used and tasted to treat COVID-19 but none have been able to be completely and definitively effective in treating the disease [47]. It is a highly infectious respiratory disease that in some people becomes so severe that it leads to hospitalization. People who recover from the disease have antibodies in their blood and immune system and these antibodies are in blood plasma so the blood plasma of improved people can be very helpful to people with severe symptoms [48,49].

To treat this disease, interferon Beta-1, as well as Keltra and Risijen have been studied and tasted and to date many of these results have been declared positive. Some people who received the drug, although many had severe symptoms were able to prevent them from being admitted to the intensive care unit [49,50]. Monoclonal antibodies (mAb) or (moAb) along with many traditional therapies, have been able to have a positive effect on people who have undergone clinical trials [51,52]. Observing some cases can have a significant impact on this disease, for example, elderly people who are affected by this disease must go to hospitals and medical centers, especially people who have underlying diseases such as diabetes, heart disease, hypertension and These people may need breathing apparatus such as oxygen and ventilators. The best way to treat this disease is to prevent and use a healthy program and diet because nutrition and the immune system are directly related, so use more vitamins such as vitamin B and C and use proteins and omega 3 foods and elements such as zinc and strengthen the immune system and avoiding carbohydrates and sugars weakens the immune system [6]. In some medical centers, some patients are prescribed antibodies such as azithromycin in combination with Hydroxychloroquine. These drugs work on bacteria disease

but COVID-19 is a viral disease. It's prescribed because in addition to being infected with the virus, the patient also has a secondary bacterial infection but unfortunately the combination of these two drugs didn't work well and increased mortality. In many cases Hydroxychloroquine has been shown to cause suffocation in most patients. The action of this drug is such that it keeps the throat secretions in the form of pus and does not allow it to come out or swallow [53,54]. Hydroxychloroquine (HCQ) is a drug prescribed for disease such as malaria, rheumatoid arthritis and lupus erythematosus. It has been tasted several times for the possible treatments of viral disease. There were many side effects such as arrhythmia, heart failure and increased mortality [55]. A number of viral drugs have been tasted to treat the disease to date such as remdesivir, which is a new antiviral drug from the family of nucleoside analogues. Nitazoxanide, which can block a wide range of respiratory viruses. Ivermectin, which can treat parasitic infections, ascariasis and worm infections and even this drug can improve acute respiratory syndrome within 48 hours. The drug favipiravir which can block the production of RNA polymerase and inhibit virus replication and the drug Merimepodib which blocks the productions of the enzyme inosine 5 monophosphate hydrogen phosphate (IMPDH), reduce the amount of guanidine used to replicate the virus. Niclosamidol, an antiparasitic drug has also been tasted for COVID-19. Rinatolimod is a receptor protein that Japanese researchers have claimed could work against COVID-19. Bemcentinib has passed the clinical trial phase well. Umifenovir is an antiviral drug that binds to hemagglutinin proteins and prevents the host cell from becoming infected with the virus. Plitidepsin is another type of antiviral drug that is still being tasted. VIR-2703 is drug that targets SRNA (RNA silencer) and turns off mRNA, thereby disrupting the RNA function of the virus. Emetine hydrochloride, which has the lethality of amoebae, especially in the intestinal wall and liver, has been studied to treat COVID-19 [56,57].

## Vaccine

With the outbreak of the coronavirus there was a worldwide attempt to obtain a vaccine [58,59]. New year 2021 it was only a week after last year that 90 year old Margaret Keenan became the first person to receive the Pfizer-BioNTech approved vaccine, despite doubts about the effectiveness of corona vaccines. By selecting a 90 year old person the experts wanted to ensure that these vaccines were reliable and effective even for vulnerable people. Given the advances in genetics that have been the basis for most vaccines, there are some that are old fashioned and weakened by viruses [60,61]. The common denominator of all corona vaccines is to train the body when it exposed to the virus so that it can produce antibodies against the virus and become resistant [62,63]. The main purpose of the vaccine is to detect external agents (pathogens) such as viruses, bacteria, parasites, etc. And the task of vaccine is to fight with the viruses [58,62]. The attenuated live viruses from which the vaccine is made include mumps, rubella and killed virus such as chickenpox also known as classical vaccines [63]. New generation platforms don't require the virus itself and only the genetic code of the virus [64]. Because scientists had previously worked on corona like viruses such as Mers and COVID-1, which belongs to the same family, they found that a series of protein spikes were on the surface of the virus, so the virus itself wasn't needed and could only be studied on spikes that work was very useful because it doesn't cause pathogenicity in humans because there is no virus at all and there is only the genetic code of the virus [58].

A new technology that made headlines in the first months of exposure to the virus in messenger RNA, in which researchers copy the viruses genetic code and inject it into a person's body and cells to make harmless proteins and then antibodies. To attack the corona virus, mRNA vaccines enter the cell's protein-producing part when they enter the body, producing virus spike [65,66]. Conventional vaccines that expose the body to viral proteins are made using attenuated or inactivated viruses, the most popular of which are the measles, rubella, mumps and pneumococcal vaccines. A virus that is non-pathogenic becomes known and produces antibodies and when exposed to a real virus, it is resistant to the viruses and diseases [62,63]. The purpose of DNA and RNA vaccines is the same as conventional and old vaccines but their functions is slightly different. In DNA vaccines, instead of injecting the attenuated state of a virus or bacterium, the genes of the virus itself are used to stimulate the body's immunity. In other words, these vaccines contain the genetic structure of host cells to make antigens. These vaccines send a message to the cell about the production of the desired protein so that the immune system can react to the protein and the body is ready to attack the protein as soon as it encounters it again. DNA and RNA vaccines have the same function and only a few differences, the DNA vaccine transmits the genetic information of the virus to another molecular called messenger RNA (mRNA), so the RNA vaccine is one step ahead of the DNA vaccine, another difference is that the DNA vaccines sends the message through a small electrical pulse and literally puts the message into the cell. The advantage of this vaccine is that it has good stability at high temperature and its disadvantage is that it needs a special device to provide electrical pulse. DNA and RNA vaccines are cost effective and have a higher rate of production than other vaccines but DNA vaccines carry the risk of permanent damage to the cells natural DNA sequence but if the mRNA injected into the genetic material of the cell doesn't integrate and the RNA messenger is ready to be converted into a protein overall advances in modern vaccines are both more cost-effective and faster than conventional vaccines[5,67]. DNA vaccines enter the cell nucleus and cell proliferation section and produce mRNA, which eventually causes to producing the virus spike [6,68].

If we don't get vaccinated, the viruses will go to all the cells and produce spikes but it will take a few days for the immune system to notice the virus and be able to fight it, but if we get vaccinated the body is ready and recognizes the virus spikes. Killed and attenuated vaccines don't make a person sick and the body may only show a mild reaction to it. The only vaccines that have been approved by the FDA are vaccines that are multiplied but the rest of the vaccines even Pfizer are in the third clinical stage and they examined for more than thousands people [67,69]. Medical systems in some countries have approved some vaccines that vary in effectiveness and maintenance. the most

prominent messenger RNA vaccines are Pfizer BioNTech and Moderna which according to their manufacturers are 95% and 94% effective. Respectively with the difference that the Pfizer vaccine must be stored at -70 degrees which is a big challenge, but the oxford vaccine which carries the genetically modified virus, is the cheapest so far at 4\$, with an efficacy of between 62% and 90% and can be stored at room temperature in the refrigerator [70].

By the end of November 2020, almost a year after the disease no FDA approved vaccine against COVID-19 was available and the world Health Organization (who) issued a license to use the Pfizer and Moderna vaccines duo to emergency conditions [71]. Inovio Company claims that it will soon rule the world in the field of corona vaccine, the company uses DNA instead of RNA to produce the vaccine [72]. The Indian government also gave the green light to two companies, Baharat Biotech and zyducadila to begin clinical trials of phase one and two vaccines. These vaccines are called Covaxin and Zycov\_D respectively[20]. Novavax, based in Maryland near the US capital, claims to have developed a vaccine using a new protein nanoparticle derived from the s-sars-cob-z protein [73]. The Voxart corona vaccine is in the form of a small pill and unlike Pfizer and Moderna, is portable and can be stored at room temperature. The Company claims that the vaccine produces about 75% T-cells in people who receive the vaccine Neutralizing antibodies were not found in volunteers who received a single dose of the vaccine[20]. Altimmune Company that is in Maryland, known for its flu vaccine has announced that it has developed an inhaled (nasal spray) vaccine against COVID-19 and is advancing clinical trials [74]. Expression Company that is in Denmark uses *Drosophila melanogaster* to producing viral antigens [75]. The only company that uses the live SARS-Cov2 virus and attenuates it in a weakened form is Codagenix [64]. Moderna Company that is in the Boston is known as for working on personalized cancer vaccine in collaboration with scientists at the national institute of Allergy and infectious Disease (NIAID). RNA-based vaccines which encodes an established form of the spike COVID protein. The company competes with Moderna, is Curevac which also uses laboratory-made mRNA to produce corona virus proteins and stimulate immune cells to make antibodies [66].

Applied DNA Company that is in the New York, announced in March that it was working with an Italian company (Takis Biotech) to deliver its DNA based candidate vaccine. Stermina Therapeutics Company has also developed an mRNA vaccine and is in clinical trials. At the college of physicians in London, a group of British Scientists are also testing a DNA-based vaccine in a laboratory. One of the leading companies in the field of vaccines production is GSK, which has lent its technology for vaccine production to the Chinese company (Clover Biopharmaceuticals). The Chinese company also produces viral proteins and GSK also provides compounds called excipients [64].

Genvex Company that is in the Florida has signed contracts with four Chinese countries to make the vaccine using proprietary safety-activating technology. IBIO Company that is in Texas uses a modified version of the tobacco plant to make viral proteins. Canadian university of Saskatchewan researchers use corona virus genome sequence to make protein based candidate. Sanofi Company has been involved in global epidemic preparedness since 2004, including the SARS epidemic. The Cxord Astraznka vaccine is made in Sweden and is part of the genetic code of the corona virus, which is inserted into a weakened common cold virus. That is not capable of causing illness in the body. The vaccine is injected twice 18 to 12 weeks apart and the safety of this vaccines is 64% and the price is 4\$ and its storage temperature is 2 to 8 degrees and we can store it in normal refrigerator temperature [70].

The co-vax vaccine which is made in India, is made from an inactive virus that is not capable of causing disease and its effect starts two weeks after the second injection of the vaccine and is licensed for people over 18 years of age. It's injected weekly and has 81% safety and is kept at a temperature of 2 to 8 degrees and costs about 5\$. The Johnson vaccine, part of the genetic code of a virus, is inserted into an adenovirus that is not capable of causing disease in the human body and enters the body. This vaccine is injected at one time and has a safety of over 66%. It is made by an American company and a Belgian branch and its price is 10\$ and its storage temperature is 2 to 8 degrees (Table 4) [64,76].

## Results and Discussion

The Moderna vaccine is produced with the new mRNA technology and is made in the United States, Spain and Switzerland. The vaccine is given twice a month apart and the safety of this vaccine is 94% and the storage temperature for this vaccine is between -15 to -25 degrees and its price is 32\$ to 37\$ [66,77].

Pfizer BioNtech vaccine is produced using mRNA technology and is made in the United States and Germany. this vaccine is also injected twice and with a maximum interval of 6 weeks and a minimum of 21 days and has a 95% safety and storage temperature of -60 degrees to -80 degrees and costs 20\$ [78].

Sinofarm vaccine made in china, which uses an old technology to inject part of the inactivated virus into the body and this vaccine is injected twice in 3 to 4 weeks and has a safety of 79% to 86% and its storage temperature is 2 to 8 degrees, It costs 150\$ [78,79].

Sputnik V vaccine is made by Russia, using the process of extracting part of the corona virus protein and is modified in a live adenovirus so that it's not pathogenic in the human body and this vaccine is injected twice at intervals of at least 4 weeks. It has 92% safety and its storage temperature is 2 to 8 degrees and its price is 10\$. The SIOVAC vaccine made in china, is made through the old process of inactivated virus and is injected twice and has a 50% safety and its storage temperature is between 2 to 8 degrees and its price is 60\$. Viruses are smart and have made many mutations but scientists say most vaccines produced to date have been able to affect a variety of virus mutations [63,80,81].

## Conclusion

Unfortunately, although many patients were able to recover from this disease and overcome it, but and no specific treatment has been available yet. The outbreaks of this virus in all over the world make it as an international concern which needs a public health emergency.

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