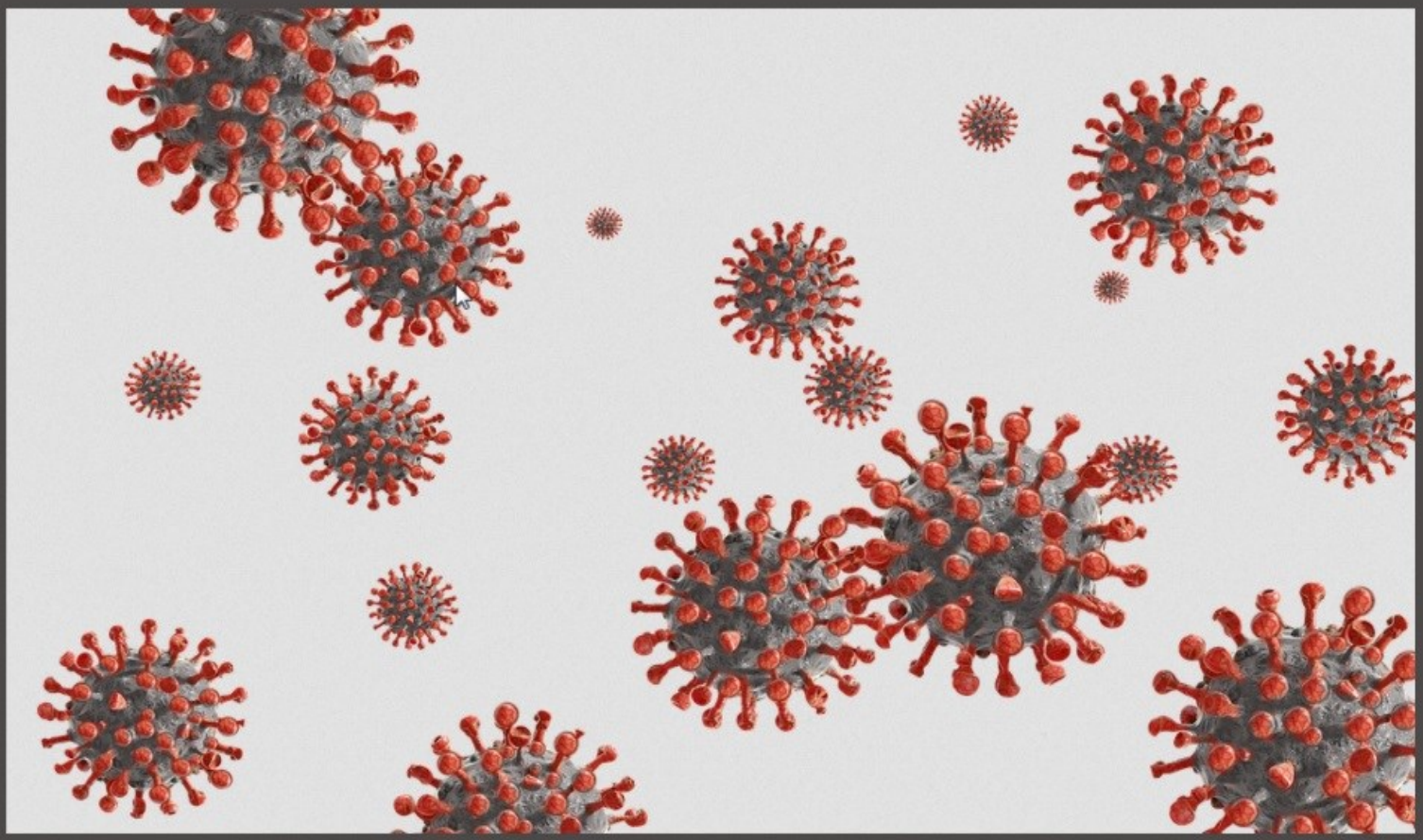
Volume 1

Coronavirus Disease (Covid-19): Scoping Review



Chief Editor
Adam A. R.
Senior Technology Architect, Infosys Limited.

Co-Editor
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Book Chapter

On

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Book Title: **Coronavirus Disease (Covid-19): Scoping Review**

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1. Impact Of Covid19 On Food Industry - Reflections From A Stakeholder Perspective

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Abstract:

Coronavirus pandemic also known as Covid19 has brought the busy world and its business functions into a turmoil leaving an adverse impact globally. From the retail and consumers perspective, impact on food safety and availability of nutritive food topped the list of challenges. United nations set zero hunger goals to be achieved by 2030 [7]. Due to the recent crisis of corona virus, achieving the target seems quite challenging. According to the recent statistics by the State of Food Security and Nutrition in the World, as many as 130 million people might deprive of nutritive food and starve. This is quite alarming. The key challenges cited are economy slowdown, food supply chain disruption, healthcare challenges, malnutrition and much more. However, this chapter focuses primarily on food safety and food supply chain perspectives of various stakeholders and how information system and emerging technologies can play an indispensable role in handling these challenges to some extent.

Most of the nations had called for lockdown and systematic unlock ever since the pandemic has been doing rounds in developed and developing nations. During the cycles of lockdown and unlock, the food production and end consumer delivery supply chain were highly perturbed, and the shortage of labour added to the menace. This chapter throws light on various stakeholders' perspectives and their reflections on food safety issues and consumer expectations and challenges in addressing the same. In addition, this chapter proposes emerging digital technologies that have potential benefits in handling challenges during such global crisis.

Keywords:

Food safety, Covid19, Impact of Covid19 on food supply chain, Emerging technologies for crisis, Consumer food safety and nutrition.

Introduction:

The recent global crisis of corona virus has gained more attention of global authorities on food safety and nutrition availability. According to the United Nations - Extreme Poverty and Human Rights forum, everyone must get an equal opportunity to food and nutrition balance. Especially, the extreme poverty- stricken sect of people must be given priority by the nations [9]. From government perspective, supply of proteins and nutritive food packages to its citizens became a high priority agenda during the pandemic.

The food production industry set its investment focus more on plant proteins while the supply chain companies restructured their operations from business to consumers with more offline points of sale like temporary markets with social distancing, door to door delivery of health packages and essentials, etc [2]. The end consumers were highly active on e-commerce (in urban areas) and voice commerce (both urban and semi urban areas) during the lockdown period due to the restricted physical movement. This shows that digital technology plays a key role in the consumer behaviour.

Literature Review:

This section looks in to existing literature on food industry related statistics, food safety norms and regulations, prevailing technologies and challenges facing the food industry as a whole globally. The global food industry and grocery retail stood at USD 7.8 trillion in 2018 and is expected to grow at around -7% CAGR (negative growth) between 2020 and 2021 adjusted to the impact of Covid-19 [10]. The expected growth is much lower compared to the projected rate of 5% CAGR between 2020 and 2025 according to statista[11].

According to USDA, the food system is a complex network of farmers and the industries that link to them. Those links include makers of farm equipment and chemicals as well as firms that provide services to agri businesses, such as providers of transportation and financial services. The system also includes the food marketing industries that link farms to consumers, and which include food and fiber processors, wholesalers, retailers, and

foodservice establishments[12] [13]. The food system recommends certain indices to measure the well being of consumers. For example, HEI Healthy Eating Index by US government sets norms for balanced diet and nutrition and average scores of various age groups of its citizens to keep a check on malnutrition and related issues. HEI average value for children aged between 2 to 18 years is about 53 points out of total score of 100 points [13]. Similarly indices are calculated based on ethnic races, income range, gender and other types of segments. Such indices are of help especially at the time of crisis like Covid-19, when the demand for protein food rose high compared to fats, meat and other dietary components.

The food industry is one of the highest contributors to GDP (Gross Domestic Product) growth of developed and developing countries. For instance, the food industry in India (the second highest populated country in the world) provides employment opportunities to nearly 120 million farmers and 140 million agriculture related industries. Another instance is that 4.8 millions of Americans are employed in agriculture and related industries. The top two regions that contribute higher growth to country's GDP through food and allied industries are Asia Pacific and Africa [14].

Though this industry enjoys the privilege of highest contributors to economy of the nations, it is posed with several challenges especially safety hazards. The four common safety hazard categories in food industry are chemical hazards, microbiological hazards, physical hazards and allergens. The other categories include temperature and humidity related hazards, agronomical hazards and so on. The best method to protect from these hazards is to follow 3C principle namely Clean, Cook and Chill which means maintain cleanliness and hygiene during food preparation cook the food thoroughly at the appropriate temperature and in accordance with the due procedures and keep the food protected from cross contamination.

Stakeholders' Of Food Industry: Attitude And Behavior – Pre Vs. Post Covid19 Comparison:

In the previous session, we had introduced various types of food hazards. This session exclusively covers the consumer attitude towards food safety and the various types of hazards. In addition, this session also presents a comparative view of consumers' attitude prior to the covid19 pandemic and the aftermath as the most preliminary studies revealed that animal foods had a role in the spread of corona viruses, though was not scientifically proven. The general level of concern on food safety increased with hazards such as chemical issues

(artificial colors, pesticide residues, hormones, preservatives, irradiated foods, excessive processing of foods, and plastic packaging), spoilage issues (restaurant sanitation, shelf-stable foods, pasteurized foods, refrigerated, prepared foods, improper food preparation, microbiological contamination and nutritional imbalances), health issues (vitamin, calorie, carbohydrate, fat, cholesterol and sugar content), regulatory issues (pesticide safety, fish and imported food inspection, and health labeling of food), deceptive practices (naturally occurring toxins, food ingredients associated with allergies and weight reduction diets advertised as healthy) and information issues (availability of detailed information at stores, markets and restaurants) [16].

Though the study by Center for disease control and prevention states that there is no empirical evidence to prove the spread of corona virus through food and food packaging or food handling units, it insists sanitation to be followed even at homes [17]. However, during lockdown period the worst impact were the restaurants, food delivery and supply chain, hotels, food courts, food processing units, packaged food handling units and so on. In the contrary, OECD (the Organization for Economic Co-operation and Development) had cited that Covid19 had adversely impacted creating bottlenecks in farm labour, processing, transport and logistics, as well as creating momentous shifts in demand. Most of these disruptions were the result of policies adopted to contain the spread of the virus. Food supply chains had faced a remarkable resilience in the face of these stresses [18]. This implies that the variations in stakeholders perspectives on food safety during and after covid19 was one of the reasons for momentous shift in demands. Another interesting trend worldwide in food and food service market was that the shift from meat based products to vegetables by omnivorous customers due to the fear of virus contamination in animal foods [19]. The market analysis by leading analysts in USA and Europe had opined that sustainable and nutritive food supply scarcity would be on the rise due to covid19 pandemic. Another interesting observation made by the analysts were that low financial investment players (small stall setups for cooked food pickup) in readymade and cooked food deliveries were on the rise during lockdown. This was primarily due to the restriction of entry in to restaurants and only take away were allowed. The demand for protein rich food and supplements also surged suddenly post covid19 and the pulses prices shot up during the lockdown period according to their observation. For online buyers, there was sudden increase in the orders placed for readymade food and groceries , however the deliveries could not be made on time due to shortage of labour availability during lockdown and transit periods.

Experts' Opinion On Food Industry Trends And Its Impact Due To Covid19:

In March 2020, the Food Price Index calculated by the UN's Food and Agriculture Organization (FAO) showed that despite surges in panic-buying among consumers in many countries, global prices actually dropped 4.3 percent from February 2020. This was largely cited as a result of Covid-19-related demand contractions amid lockdowns and quarantines. Another probable reason could be fear of unemployment owing to lockdown and impact on purchasing power of consumers. According to CSIS, the outlook for farmers in low- and middle-income countries where agriculture accounts for a greater share of GDP, relative to wealthier countries is worse due to shortage of labor [20].The world bank looks at this issue from a different perspective of exports and closed borders during lockdown[21]. Despite demand , the supply could not be met due to pandemic restrictions prevailed from April 2020 for different time periods in different countries ranging from a month to several months. The experts also opined that the food industry and its production to be viewed from multiple dimensions such as affordability, accessibility, sustainability, availability and nutritional values of the food produced especially as an outcome of covid19 crisis. Prior to covid19, many countries did not consider labour shortage in farming seriously, but due to the disruptions created in demand supply chain as an impact of covid19, many countries are now revisiting their assessment of food and agriculture industry for future sustainability [22].

Challenges Facing Food Industry And Trends In The Recent Times:

The key challenges facing food industry as a whole are food scarcity, extreme hunger people, food security, demand supply mismatch, shortage of labour, consumers craving for convenience due to lockdowns and quarantines, demand for high protein and fibrous food supplies, price pressure and so on. The right to adequate food as a basic human right was first recognized in the Universal Declaration of Human Rights in 1948, as part of the right to a decent standard of living (Art. 25): 'Everyone has the right to a standard of living adequate for the health and well being of himself and his family, including food.' It became legally binding when the International Covenant on Economic, Social and Cultural Rights (ICESCR) entered into force in 1976 [23]. Today, due to covid 19 impact several millions (as high as 260 millions) are pushed to the category of extreme hunger from last year of 2019.In the world's highly populated countries like India and China, "zero hunger" sustainability goal is still a dream far away. These countries grapple with challenges such as poverty, famine, shortage in food supply and massive hike in prices of basic foodstuffs and recent coronavirus

crisis [24]. DST-NRF Centre of Excellence in Food Security (CoE) is an initiative of the Department of Science and Technology – National Research Foundation. The mission of the CoE is to examine how a sustainable and healthy food system can be achieved, to realise food security for poor, vulnerable and marginal populations [25]. This COE also stated that every year,6 million children die, directly or indirectly, from the consequences of undernourishment and malnutrition – that is, 1 child every 5 seconds which is quite alarming. As we listed earlier, accountability from the government, access to food resources for certain sects of people are all vital to fight against food insecurity and poverty. Malnutrition is already a known challenge and with recent corona crisis, the need for protein and fiber rich food supplies has surged and meeting such sudden splash of demand bound to be very difficult for densely populated countries. With industrialization and development on one hand, shortage of farming land and labour on the other hand, meeting both ends needs strategic planning at a higher level.

Mitigating Challenges With Emerging Digital Technologies – A Viewpoint:

Food security is a global challenge. According to recent data from the United States Department of Agriculture (USDA), approximately 14.7% of U.S. households experience low or very low food security. This equates to nearly 50 million people in the United States, including about 17 million children [26].In response to food insecurity, the U.S. government offers food assistance to low income families through a program namely Supplemental Nutrition Assistance Program (SNAP). This program facilitates families with electronic benefits like a debit card to purchase breads, cereals, fruits, vegetables, meat, and dairy products from approved stores . The federal government also funds school breakfast and lunch programs and mid noon meal scheme is a known practice in countries like India several decades ago. Some community-based organizations, such as food banks, help address families' immediate food needs, while other volunteer groups work to address the root causes of food insecurity, improve local access to nutritious food, and provide community-based nutrition education. Blockchain is yet another emerging digital technology allowing all pervasive financial transactions among distributed untrusted parties, without the need of intermediaries such as banks [26]. This is an enhancement of service as against earlier discussion on debit card or credit card from pre-approved stores by federal government. Here there is no need for any intermediaries like retailers, banks or third party transaction service providers. A blockchain is a digital transaction ledger, maintained by a network of multiple

computing machines that are not relying on a trusted third party [26]. Individual transaction data files (blocks) are managed through set of software platforms that allow the data to be transmitted, processed, stored, and represented in human readable form. The food chain globally is highly multi-role based and distributed, with numerous different actors involved, such as farmers, supply chain players, wholesalers and retailers, distributors, and consumers. It is found that the cost of operating supply chains makes up two thirds of the final cost of goods [26]. Thus, there is much space for optimization of the supply chains, by effectively reducing the operating costs using bit coins and blockchain technologies. As the transactions are highly secured, it avoids errors and fraudulent acts due to manual intervention as depicted in the figure 1 given below.

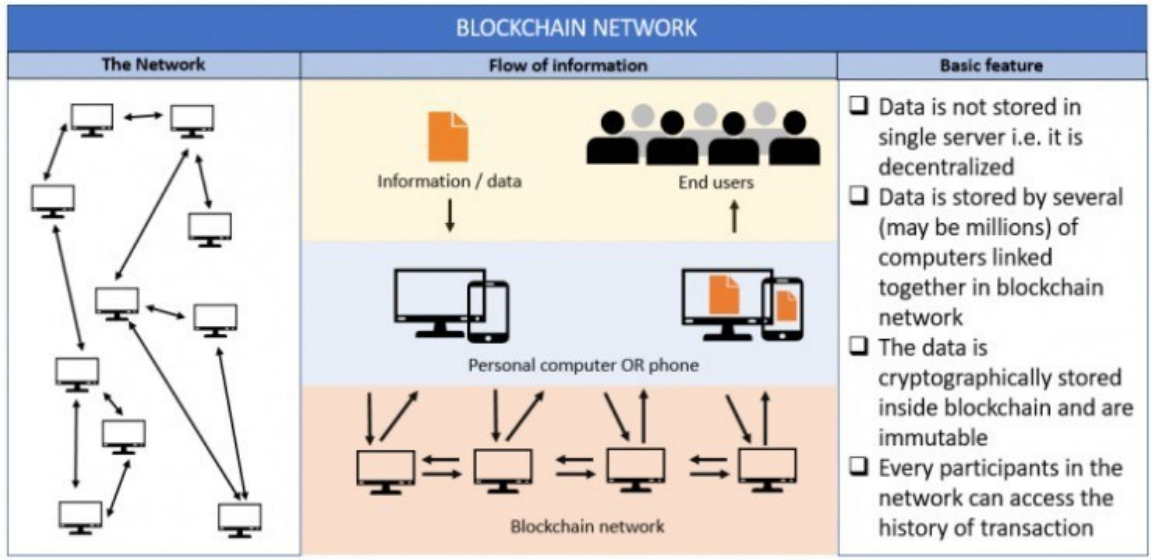

Figure 1: Pictorial depiction of flow of information in current server network and blockchain network

According to Juniper research report, 'Key Vertical Opportunities, Trends & Challenges 2019-2030', blockchain used with IoT sensors and trackers will have several advantages as mentioned below [28].

1. Blockchain technologies embedded with IoT capabilities will streamline the supply chain, reducing retailers' costs
2. These technologies offer simpler regulatory compliance
3. It will enhance and expedite the food recall process
4. It will enable $31 billion in food fraud savings globally by 2024

Another trend of digital technologies pervading food and agriculture industry is the smart farming. There are several startups which could provide digital assistance to local farmers at an affordable cost. This predominantly helps farmers monitor the crop temperature, humidity, soil fertility and several other important parameters using their mobile phone itself. There are other expensive techniques for large farm monitoring and forest monitoring like drones, satellite imagery analysis, embedded sensors in the farmland and so on which could not be afforded by all farmers. However we find that the emerging digital technologies play a vital role in food and agriculture industry development and help address some of the challenges discussed in this chapter throughout.

Summary And Future Directions:

This chapter views food industry from various stakeholders perspective especially during the global pandemic crisis and how various players of the food industry are adversely impacted due to covid19 issue. This chapter also listed out some of the prominent challenges facing the industry and how various analysts, experts and policy makers look at the industry in a holistic manner. This chapter also discussed some of the emerging technologies and their support during global crisis worsened with lockdown and quarantines. The coronavirus pandemic has taught us following of social distancing and cleanliness at all times going forward. In future, we could witness more start up technology companies playing an indispensable role in the research of high yield good quality crops, seeds, scientific based cultivation with less available cultivable lands, real time monitoring of farms, timely decision making by farmers and agriculturists, dynamic pricing strategies powered by digital technologies and so on. The emerging digital technologies have enabled the solution providers, policy makers, governments and other tech savvy stakeholders to revisit the food industry from the dimensions of access to information technologies, affordability and utilization of such technologies right from production to marketing of goods and services and that is the path ahead towards zero hunger sustainability goals.

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2. A Brief Overview Of SARS-COV2, SARS-Cov And MERS-Cov Coronaviruses Outbreak To Global Health

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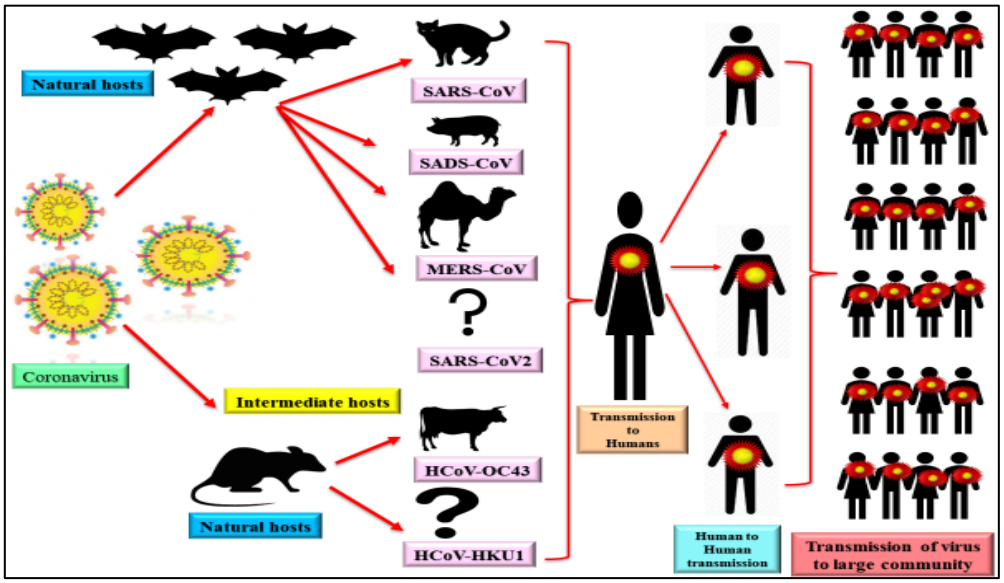
Abstract:

In the previous year's numerous viral infections have observed and affected the human's fraternity and healthcare systems. In all over the world millions of people are at a severe risk due to the several viral infections spread in the environment through various factors. In present investigation we have discussed the comparative forms of various viral infections and their risk factors, infection, methods and prevention Middle East Respiratory Syndrome Coronavirus (MERS-CoV) and severe acute respiratory syndrome (SARS-CoV) and COVID-19 (severe acute respiratory syndrome (SARS-CoV2) which causes severe damage to the lungs, Kidney and heart and frequently causes normal illness, cold, fever, headache and chills in the human body. All the zoonotic transmissions of CoV that are newly discovered MERS-CoV, SARS-CoV and SARS-CoV2 is associated with the lower respiratory tract infections. We discussed about the recent clinical and pathological information on MERS-CoV, SARS-CoV and SARS-CoV2. The main aim of this review is to discuss about the discoveries related to MERS-CoV, SARS-CoV and SARS-CoV2 pathogeny and develop the methods that will eventually allow the effective control measures of these several severe viral infections. In the present article we have reviewed the literature on the several facets like transmission, precautions and effectiveness of treatments used in patients with MERS-CoV and SARS-CoV and SARs-COV2 infections.

Keywords:

Coronavirus; COVID-19; MARS-CoV; SARS-CoV; SARS-CoV2.

Graphical Abstract:



Introduction:

In recent years, several life-threatening viruses have been emerged in all over the world. They are responsible for causing significant human mortality, in addition to raising serious public health concerns to worldwide [1]. The life style and due to modern life, extensive travel of humans and goods, their outbreak anywhere in the world could potentially be a risk for the living creatures. The coronavirus that causes SARS is called SARS-CoV. In the recent times, two novel viruses were implicated and are said to be responsible for the severe acute illness, i.e. Middle East Respiratory Syndrome-Corona-Virus (MERS-CoV) and severe acute respiratory syndrome-corona-virus (SARS-CoV) [2,3] (Fig. 1). On new virus which is spread in all over the world i.e. SARS-CoV2 is a novel coronavirus identified as the cause of coronavirus disease 2019 (COVID-19) that began in Wuhan, China in late 2019 and spread worldwide [1]. These viruses are causing acute and often fatal illness, headache, fever etc and due to their high fatality rate (20–80%), they have had dual effect: and has great fear among public from contracting one or more of them as well as high burden on the healthcare system, including the treating physician and other health care workers.

The reservoir of the viruses (MERS-CoV, SARS-CoV and SARs-COV2) is said to be usually animal, including: bats, camels, or Cat. And then the transmission of animal to humans occurs and then, human to human transmission has been reported in recent studies, usually from an infected patient and to the member of the health care team and too their patients in

the hospital too. Till now no such specific treatment and vaccine has been recommended for their management and some supportive treatment has shown to improve the outcome in various research [4].

Some articles and research concluded about the process of antiviral vaccines is under process. These novel viruses represent significant challenges to public health in general and to public health services and infection control in specific area [5]. Many educational awareness and multidirectional care can improve the disease outcomes. In the present article we discussed an accurate knowledge of their reservoir, their transmission, presenting symptoms approach to their investigation and best possible management together with preventive steps, is necessary. In the present article we have reviewed the literature on several aspects like transmission, safety and efficacy of the rapies used in patients with MERS-CoV, SARS-CoV and SARS-CoV2 infections [3,6].

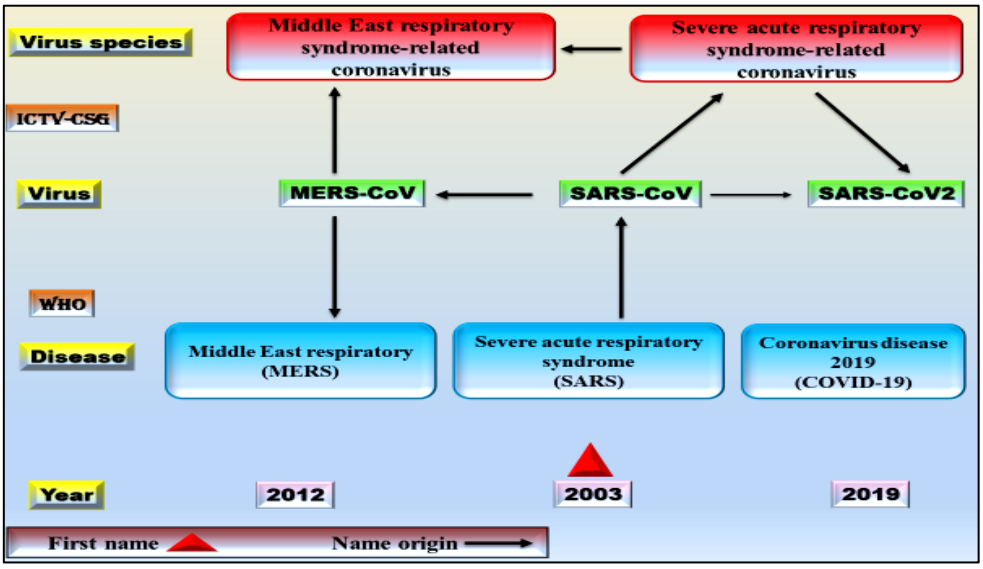


Figure 1: Details of MERS-CoV, SARS-CoV and SARS-COV2.

2. The Order Of Nidovirales:

The name Nidovirales, is derived from the Latin word “nidus” which means for nest, refers to a nested set of viral sub genomic messenger RNAs that is produced during the viral infection[7]. The order of Nidovirales is an order of enveloped, RNA viruses of single-stranded positive genomic. It is been stated that they have the largest known viral RNA genomes and they infect a large range of hosts. The order of Nidovirales includes three virus families: Roniviridae, Arteridae, and Coronaviridae is been summarized in (Fig. 2). The sequence of the coronaviridae family is divided into subfamily subfamily Coronavirinae

which contains the largest number of viruses till now. Several human pathogens are included in subfamily and are grouped in four different subgroups on their genetic properties they are Alphacorona virus, Beta coronavirus, Gamma coronavirus, and Delta coronavirus. On more sub family of coronaviridae is Torovirinae [8-10]. Research indicated that their virions are 60–80 nm in diameter, with club-shaped surface spikes and consist of eight major structural proteins, including a nucleocapsid protein, four differentially glycosylated forms of the membrane protein, and the spike S protein. Another is Roniviridae which contain the genus Okavirus and although still little knowledge has been known about them. (Fig. 2).

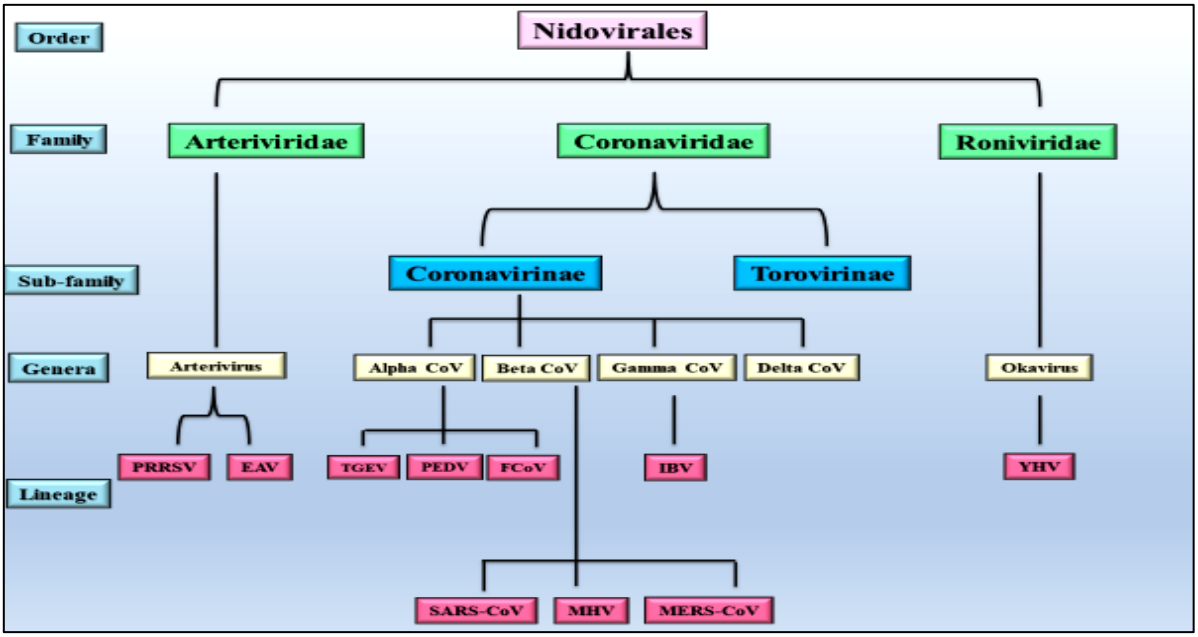


Figure 2: The taxonomy of the order nidovirales.

Abbreviations:

EAV = equine arteritis virus; **FCoV** = feline coronavirus; **IBV** = infectious bronchitis virus; **MERS-CoV** = middle east respiratory syndrome coronavirus; **MHV** = mouse hepatitis virus; **PRRSV** = porcine reproductive and respiratory syndrome virus; **PEDV** = porcine epidemic diarrhea virus; **PToV** = procine torovirus; **TGEV** = transmissible gastroenteritis coronavirus; **SARS-CoV** = severe acute respiratory syndrome coronavirus; **YHV** = yellow head virus.

3. Pathogenesis comparison of SARS-CoV2, SARS-CoV and MERS-CoV:

SARS-CoV and MERS-CoV enter target cells through an endosomal pathway. In all the viruses 5′UTR and 3′UTR are involved in intermolecular and intramolecular interactions and

are functionally important for RNA–RNA interactions and for binding to viral and cellular proteins (Table 1) [1]. At 5 ends, Pb1ab is the first ORF of the whole genome length encoding non-structural proteins with size of 29844bp (7096aa), 29751bp (7073aa) and 30119bp (7078) in COVID-19, SARS-CoV; and MERS-CoV, respectively. In the investigation when even with comparison of the spike protein at 3′ end, among the coronaviruses specifically these three beta coronaviruses, the difference was visualized, 1273aa, 21493aa, and 1270aa in COVID-19, SARS-CoV, and MERS-CoV, respectively. Genetically, COVID-19 was less similar to SARS-CoV (about 79%) and MERS-CoV (about 50%). The arrangement of nucleocapsid protein (N), envelope protein (E), and membrane protein (M) among beta coronaviruses are different as shown in Fig. 3.

Table 1: Pathogenetic Characteristics Of SARS-CoV2, SARS-CoV And MERS-CoV.

S.No.	Characteristic	SARS-CoV2	SARS-CoV	MERS-CoV
1.	First identifies locations	Wuhan, China	Guangdong, China	Jeddah, Saudi Arabia
2.	Period	2019-present	2002-2003	2012
3.	Origin	Clade I, cluster IIa	Clade I, cluster IIb	Cluster II
4.	Animal Source	Bats	Bats	Bats
5.	Intermediate host	Not known	Palm civets	Camels
6.	Receptor	(ACE2) Angiotensin-converting enzyme 2	(ACE2) Angiotensin-converting enzyme 2	(DPP4) Dipeptidyl peptidase 4
7.	Mode of transmission	Respiratory droplets, contact	Respiratory droplets, contact	Respiratory droplets, contact
8.	Fatality rate	3.3%	9.5%	34.4%
9.	R_0	2-3.5	2 -5.9	0.7
10.	Incubation period	Median 5.1 days (95% Cl, 2.2-11.5)	Mean 4.6 days (95% Cl, 3.8-5.8)	Median 5.2 days (95% Cl,1.9-14.7)

Abbreviations: *R_0 = Basic reproduction number; Cl = Confidence interval*

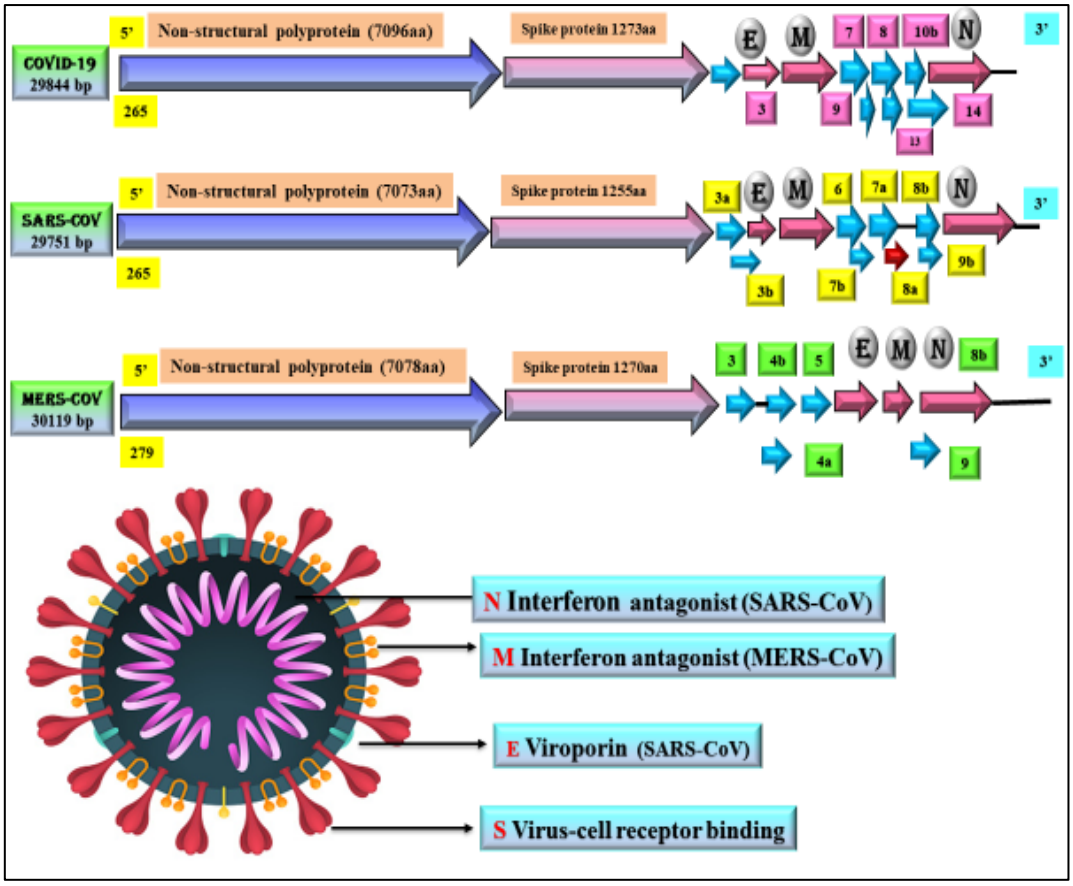


Figure 3: Representation of coding region of COVID-19, SARS-CoV and MERS-CoV in 5' UTR and 3' UTR ends.

4. Pathology Comparison And Life Cycle Of SARS-CoV And MERS-CoV:

In the life cycle of the SARS-CoV2 the S proteins of SARS and MERS bind to cellular receptor angiotensin-converting enzyme 2 (ACE2) and cellular receptor dipeptidyl peptidase 4 (DPP4), respectively. Following entry of the virus into the host cell, the viral RNA is unveiled in the cytoplasm. ORF1a and ORF1ab are translated to produce pp1a and pp1ab polyproteins, which are cleared by the proteases that are encoded by ORF1a to yield 16 non-structural proteins that form the RNA replicase-transcriptase complex [11-15]. This complex drives the production of negative-sense RNAs [(−) RNA] through both replication and transcription. During replication, full-length (−) RNA copies of the genome are produced and used as templates for full-length (+) RNA genomes. During transcription, a subset of 7-9 sub-genomic RNAs, including those encoding all structural proteins, is produced through discontinuous transcription. Although the different sub-genomic mRNAs may contain several open reading frames (ORFs), only the first ORF (that closest to the 5′ end) is translated. Viral nucleocapsids are assembled from genomic RNA and N protein in the cytoplasm, followed

by budding into the lumen of the ERGIC (endoplasmic reticulum (ER)-Golgi intermediate compartment). The Virions are then released from the infected cell through exocytosis. SARS-CoV, severe acute respiratory syndrome coronavirus; MERS-CoV, Middle East respiratory syndrome coronavirus; S, spike; E, envelope; M, membrane; N, nucleocapsid[11-13] (Fig. 4). Genomic analysis on accumulating evidence suggests that SARS-CoV-2 shares with SARS-CoV the same human cell receptor, the angiotensin-converting enzyme 2 (ACE2), while MERS-CoV uses dipeptidyl peptidase 4 (DPP4) to enter host cells according to some review literature [23]. SARS-CoV-2 has no amino acid substitutions were present in the RBD and that directly interacts with human receptor angiotensin-converting enzyme 2 (ACE2) compared with SARS-CoV. The pathogenicity of SARSCoV-2 must be further investigated and detected. Receptor analysis affinity detected that SARS-CoV-2 binds ACE2 more efficiently than the SARS-CoV. Angiotensin-converting enzyme 2 receptor (ACE2) is an ectoenzyme anchored to the plasma membrane of the cells of several tissues, especially those of the lower respiratory tract, heart, kidney and gastrointestinal tract. SARS-CoV highly replicates in the type I and II pneumocytes and in enterocytes, and the SARS-induced downregulation of ACE2 receptors in lung epithelium contributes to the pathogenesis of acute lung injury and subsequent ARDS [24-26].

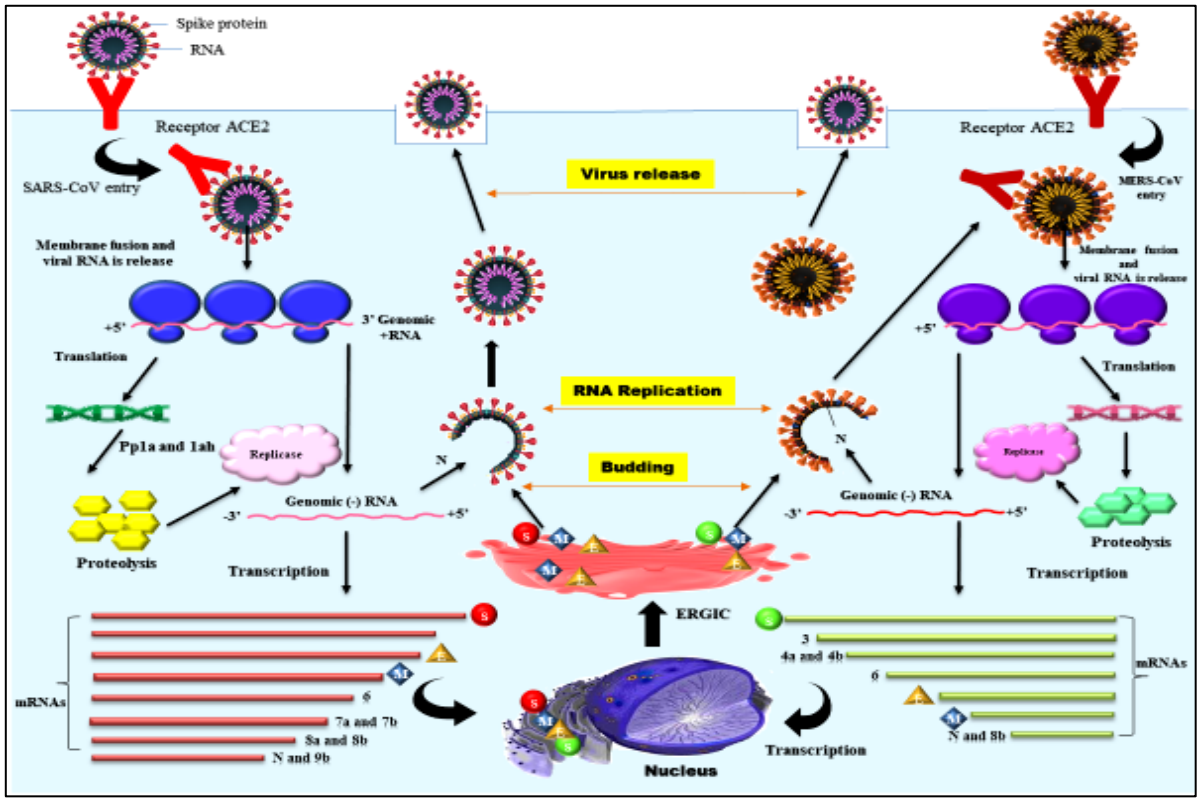


Figure 4: Representation of life cycle of SARS-CoV2 and MERS-CoV in host cells.

4. SARS-CoV-2 Virus:

4.1. Origin:

All types of coronaviruses that have caused diseases to humans have had animal origins-generally either in bats or camels as per the review literature [16]. Previously research review convoluted that the outbreaks of beta coronaviruses in humans was involved directly due to the animals except bats, but in case of SARS-CoV and MERS-CoV, they were transmitted directly to humans' transmissions from civet cats and dromedary camels and in case of SARS-CoV2, it is still unknown. The spike proteins that contain a variable receptor-binding domain (RBD) can be covered by SARS related coronaviruses. The receptor-binding domain binds with angiotensin-converting enzyme-2 receptor that are found in the heart, kidney, lungs and gastrointestinal tract and entered to the target cells [17]. The RBD of the SARS-CoV2 appears to be a version of various other related virus and RaTG13 in Rhinolophus affinis bats. Therefore, it is estimated that the SARS-CoV-2 can be also originated from bats. The pangolin is believed to be the intermediate host of SARS-CoV-2 according to some research [18-20].

4.2. Transmission Of SARS-CoV2:

The transmission of the early COVID-19 cases was linked from the Wuhan market, china and it is estimated that the virus was initially transmitted from animals to humans from Wuhan market. Human to human transmission spread through human contact with infected secretions with large respiratory droplets. Researchers are still learning how readily this virus spreads from human to human or how sustainable infection will be in a population, although it appears more transmissible than SARS-CoV and spread is probably more similar to that of influenza. Isolation and Quarantine measures are being applied to limit the local, regional, and global spread of this SARS-CoV outbreak [21,22].

4.3. Symptoms And Signs:

SARS-CoV2 people may have few to no symptoms, although some become severely ill and die. Some symptoms can include Fever, Cough, Shortness of breath or difficulty breathing, Chills, Muscle pain, Headache, Sore throat and new loss of smell or taste according to the investigation of the COVID-19 patients (Fig. 5). The incubation time ranges from 2 to 14

days after exposure to the virus. The risk of serious disease and death in COVID-19 cases increases with age and in people with other serious medical disorders, such as heart or lung disease or diabetes [1].

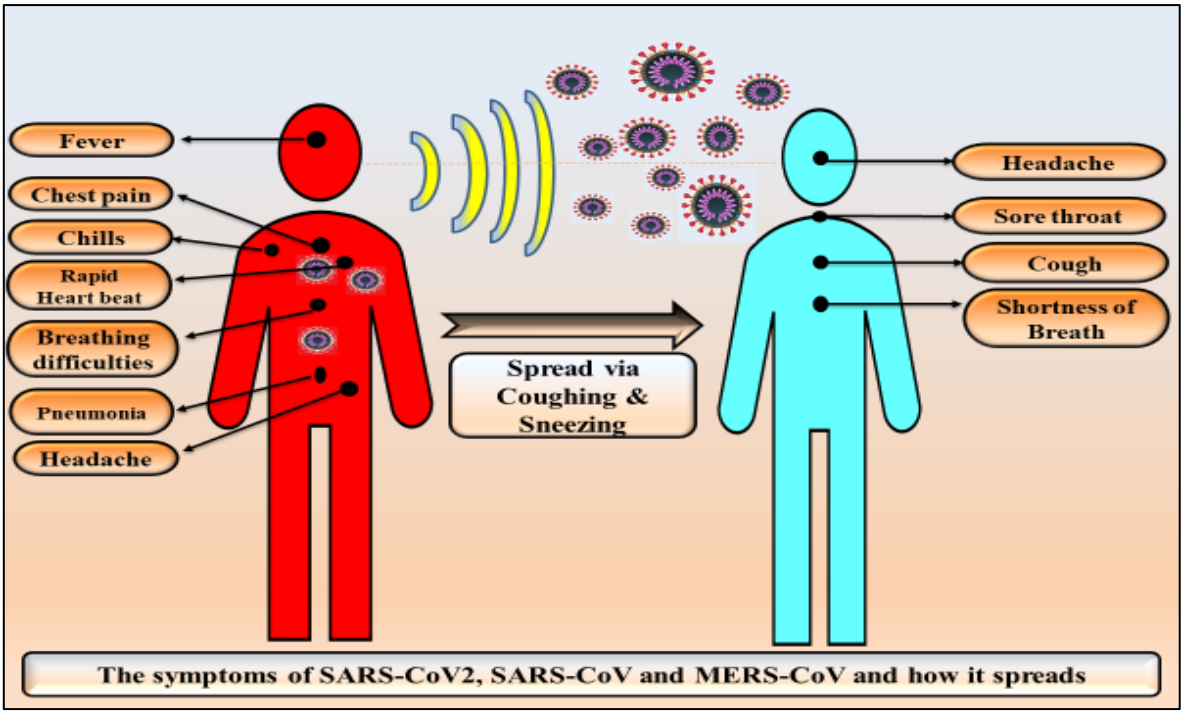


Figure 5: Representation of the symptoms of SARS-CoV2, SARS-CoV and MERS-CoV and how it spread.

4.4. Diagnosis of SARS-CoV2:

In the diagnosis of SARS-CoV2 reverse transcriptase-polymerase chain reaction (RT-PCR) testing is increasing through hospital-based laboratory for upper and lower respiratory secretions diagnostic testing. Initial diagnostic testing for COVID-19, the CDC recommends collecting and testing a single upper respiratory nasopharyngeal swab. According to WHO the collection of nasal turbinate and/or oropharyngeal swabs is acceptable if nasopharyngeal swab is not identified or available. COVID-19 patient a lower respiratory tract aspirate or bronchoalveolar lavage sample should be collected and tested as a lower respiratory tract specimen and invasive mechanical ventilation should be provided. Nasopharyngeal swab should be used for the collection of oropharyngeal swabs and combined.

4.5. SARS-CoV2 Treatment:

No vaccine, antiviral drug, or other specific treatment is available till now and all over 175 treatment and vaccine clinical trials are currently registered, but still the data on effective therapy remains sparse. Current therapeutic strategies in practice for severe disease include antiviral agents (notably redelivers, in clinical trial), chloroquine derivatives, and immunomodulatory agents, namely Il-6 inhibitors such as tocilizumab. Therapeutic agent are benefits and weighed against possible risks for each patient suffering from the virus and to help prevent spread from suspected cases, health care1. Airborne precautions are particularly relevant for patients undergoing aerosol-generating procedures. Respiratory symptoms Patients should be identified and masked immediately upon entry to any healthcare facility.

5. SARS-CoV Virus:

5.1. Origin:

It was first identified in 2002 in China. WHO has defined SARS as a global threat caused by SARS-CoV coronavirus Severe acute respiratory syndrome (SARS) was considered among newly emerged infectious diseases, with a significant morbidity and mortality, Due to a high case fatality rate, accurate knowledge of the SARS-CoV remains a Mistry? According to the Centers for Disease Control and Prevention, Challenges presented by MERS corona and SARS corona viruses reports as many as 8273 cases were confirmed from 37 countries around the world with 775 deaths, a case-fatality of about 10%.

5.2. Transmission Of SARS-CoV:

It is believed that SARS transmitted and penetrates through respiratory aerosols, which were released while a SARS patient coughs or sneezes. Viral infection will spread from the droplets of cough or sneeze of an infected patient are propelled in surroundings via air and will infect the nearby people who are nearby through several ways like mouth, nose or eyes. The virus also can spread by touching infected surfaces, and then touching the mouth, nose, or eye etc. [27].

5.3. Signs And Symptoms:

Signs and symptoms of SARS-CoV include: discomfort in respiration, high fever, migraine, and body pains, slight respiratory problem, diarrhea (10–20%), and cough (after 2–7 days). Incubation period of the SARS-CoV ranges from 2 to 10 days.

5.4. Diagnosis Of SARS-CoV:

In PCR testing SARs is a new viral disease that is caused by the human to human transmission and anti-SARS-CoV antibodies are not found in populations that have not been exposed to the virus. Antibody testing using immune fluorescent antibody (IFA) tests is being developed by various research laboratories. Meanwhile, additional antiviral therapy, RNA silencing methods, anti-monoclonal antibody, anti-viral peptides, and vaccines are under development process.

5.5. Prevention:

Scientist and Scholars are working on various types of vaccines for the treatment of SARS, but still these vaccines need to be approved to test in humans.

6. MERS-CoV Virus:

6.1. Origin:

Middle East respiratory syndrome (MERS) is a severe, acute respiratory illness caused by the MERS coronavirus (MERS-CoV). MERS-CoV infection was first reported in September 2012 in Saudi Arabia, but the resources concluded that an outbreak in April 2012 in Jordan was confirmed retrospectively. Till 2019 in whole world wide affrox 2500 cases were reported due to MERS-CoV infection (with at least 850 related deaths) have been reported from 27 countries; all cases of MERS have been linked through travel to or residence in countries in and near the Arabian Peninsula, with > 80% involving Saudi Arabia. In the report it state that the largest known outbreak of MERS is been detected in the Arabian Peninsula occurred in the Republic of Korea in 2015. The main reason of the outbreak is associated with the travelling from the Arabic Peninsular region. According to WHO report in January, 2016 said that 1638 human cases, including 587 deaths due to Middle East Respiratory Syndrome (MERS-CoV) [4,28]. Recommendation of the WHO, MERS is a

deadly disease caused by coronavirus, ‘‘is a threat to entire world” [29-32]. MERS-CoV is considered a deadly virus with a single strand RNA [33]. The MERS-CoV has been identified in various countries in the gulf region, Korea and European region with an obviously high death rate and dangerous conditions. According to the nosocomial transmission it is been compared to the SARS-CoV which is involved in various respiratory diseases and infections in the various parts of the body [34]. The person travelling from Saudi Arabia to USA was the first case found and identified on 2nd May 2014 due to MERS-CoV. The second instance of MERS-CoV was reported on 11th May, 2014, and was confirmed in a traveler who is also from the Kingdom of Saudi Arabia. Another instance was from Republic of Korea’s first, or ‘‘index”, case was confirmed on 20 May 2015 and notified from WHO. MERS virus from nasal swabs of camels and demonstrated that the whole genome sequence of human and camel obtained virus is in distinguishable [30]. Although person-to-person transmission is low, in these cases and it does occur from patients to health care workers and close contacts with them.

6.2. Sources Of Virus:

Studies indicated that the main source and reservoirs of the MARS-CoV was “Camels”. The people affected by the infection were found to be closed contact with the animal in the form of drinking camel milk etc. 100% of Oman camels and 16% of Spanish camels had antibodies against MERS-CoV according to the Lancet Infections Diseases reports on 2013 August.

6.3. MERS-CoV Transmission:

In humans Camels are considered the source of infection. Subsequently, human to human transmission of MERS-CoV occurs from patients to health care workers through drop let infection, or through touching contaminated surfaces according to the reports [35] (Fig. 6).

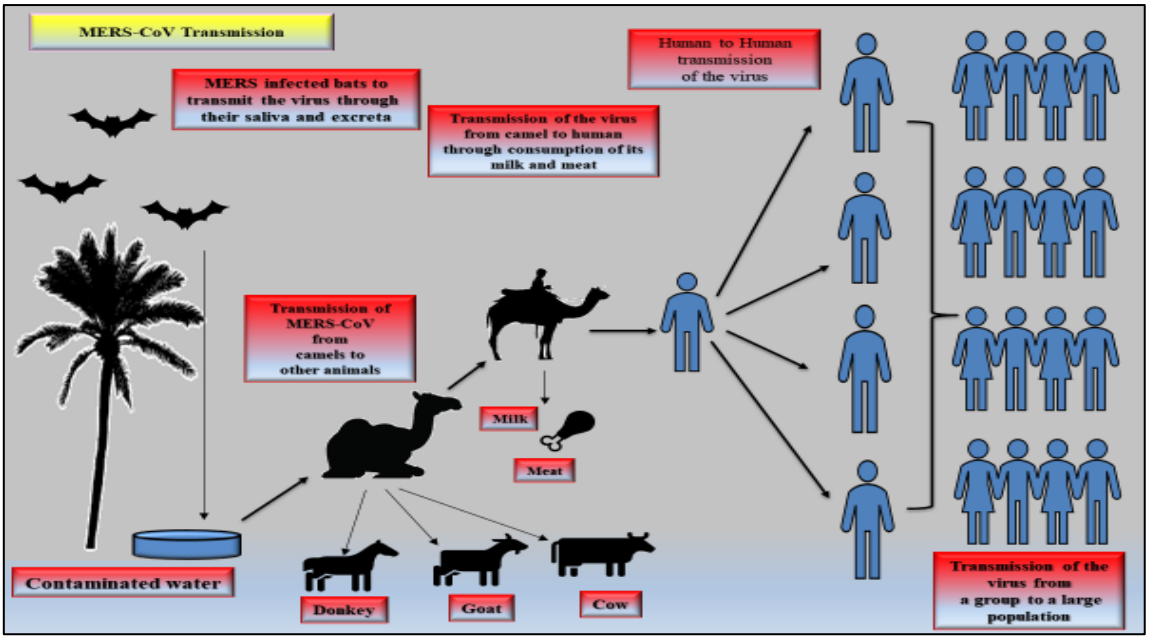


Figure 6: Representation of MERS-CoV transmission.

6.4. MERS-CoV Incubation:

MERS-CoV infection was incubated during the period of ranges from 2 to14 days [29].

6.5. MERS-CoV Epidemiology:

In the summers 2012 in Saudi Arabian city in Jeddah a CoV coronavirus was detected and identified from the saliva of a patient suffering from acute pneumonia and renal failure. Till September 2012 a similar type of virus was transmitted in human was named as human coronavirus was isolated by a patient suffering from severe respiratory infection who traveled from the Middle Eastto London, United Kingdom [4,29,36,37]. In Oman they confirmed that it was second MERS-CoV case of 2014 and its overall fourth apparently a contact of the most recent MERS patient, who has died, according to media reports.

After confirming eight MERS-CoV cases, Saudi Arabia reported 833 confirmed cases, including 358 deaths, for a case-fatality rate of 43% in the first 9 days of 2015.

6.7. Signs And Symptoms:

Signs and symptoms comprise for MERS-CoV: rigor, feeling cold, shivering, migraine, cough, sore throat, difficulty in breathing, muscular rheumatism, chest pain, kidney failure,

pneumonia, giddiness, nausea and vomiting, dysentery, and stomach pain. In the various reports and reviews it has been reported that the symptoms are same as development of pneumonia. It must be noted that by MERS-CoV immune-compromised people are thought to be a thigh risk to get infected.

6.8. Diagnosis Of MERS-CoV:

Identify and diagnose several infectious diseases through PCR testing diagnosis method is used used to confirm MERS-CoV positive cases by collecting sputum or any other sample from the patient. A blood test can decide whether a person has earlier been infected, by anti-MERS-CoV [38]. MERS-CoV in USA remains serious, with the evolution of a new wave of cases during early 2015, with still a high fatality rate ranging from 30% to 40%. Drinking unsterilized camels' milk must be avoided till convincing proof is obtained, so that chances of infection were reduced.

6.9. Infection Control:

Viral disease control is the key to ensure protection for healthcare employees and patients. Convalescent plasma, lopinavir and interferon (IFN) are prescribed for better management of MERS-CoV infected persons. The effect of steroids on viral infection control in MERS is not well known, even though systemic corticosteroid usage delayed clearance of the related coronavirus, SARS-CoV. MERS-CoV has been compared with delayed replication of other respiratory infections. According to Various medical research stated that Cyclosporin A (CsA), cycloheximide, mycophenolate, IFN-b, omacetaxine mepesuccinate, anisomycin, and emetine dihydrochloride hydrate were identified to show the best result in protective effect from MERS-CoV [39].

7. Safety Guidelines Recommended By WHO (Fig. 7):

Fig. 7. Representation of infections control and prevention measures.

8. Conclusions And Future Aspects:

The most important lessons we have learned from the past from the SARS-CoV and MERS-CoV coronavirus epidemic are the most specific weapons we have to face in the new global era. There is still much more to know about the emergence of recent coronavirus outbreak in all worldwide COVID-19 caused by SARS-CoV-2, and has proved that these viruses has the capacity to mutate and recombined to become pathogenic and has the intensity to cross the barriers can cause virus transmission in animals and human and much more to understand its capacity and mortality to spread and keep on emerging all over the world. As, it can spread through aerosol droplets, indirect and direct contact, person to person transmission as well as in the laboratory setting. Also, it can be transmitted from bats to humans, which confirms its zoonotic importance. It is very important and essential to develop the effective vaccines and antiviral therapeutics. With the comparative analysis of the recent SARS-CoV2 coronavirus outbreak with the previous corona-virus outbreaks (i.e SARS-CoV and MERS-CoV) as these disease has no treatment and proper measures should be taken to control the virus and can help and provide to used and leads for developing therapeutics and vaccines for this virus. To control SARS-CoV2, prevention and recommendation for future that each country

of the worldwide should give proper attention to the quarantine and diagnosis facilities, in which the suspected person is kept in the isolation. As many pharmaceutical organization, medical workers, Scientists, Researchers are working hard to prepare the vaccine or drug and control the virus. Most important are the prevention measures that are implemented all over the world and are fighting against the viral disease. This work will be very helpful for the discovery of COVID-19 vaccine.

Conflicts Of Interest:

The authors declare no conflict of interest.

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3. World Threat COVID-19: The Pathogenesis, Genetic Journey And Proof Based Remedial Control

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Abstract:

The Novel Corona virus infection (COVID 19) has become a persistent public wellbeing emergency with global impact. It is profoundly transmissible and is characterized as a pandemic of severe respiratory distress, flue like symptoms associated with brevity of breath; on the other hand asymptomatic cases have also been observed, which is become serious threat to the World. The SARS-CoV-2 viral disease started in Wuhan, Hubei Province, China in December 2019. The COVID-19 pandemic keeps developing in 216 nations/domains, around 10 021 401affirmed cases and about 499 913 confirmed deaths have been documented. In this chapter, we survey the accessible proof about the study of origin, spread dynamics, pathophysiology, examination probes and the management for COVID-19. Finding is affirmed with PCR based testing of suitable respiratory samples. A few nations are leading clinical trials to evolve and ascertain COVID-19 killing impact of existing medication and new medication moieties as well. A model medication repurposing dependent on constrained trials incorporates chloroquine, hydroxychloroquine, remdesvir, lopinavir and plasma treatment hold guarantee for the treating of COVID-19. As far as the development of vaccine is concerned genetic configuration plays significant role. New bits of knowledge into the pathophysiology, clinical highlights and management of this virus are continuously revealing by the researchers. Thus, by sharing information and extending our comprehension of the virus genetics and the illness pathogenesis, we accept that the scientific community can proficiently create viable vaccine and drugs, and the humanity will definitely win this fight against nCOVID-19 pandemic.

Keywords:

COVID-19, Asymptomatic, Pathophysiology, Virus Genetics, Drug Repurposing, Vaccine

Background:

Contagious ailments stay as the significant reasons for human and animals unhealthful and mortality, prompting huge medicinal services expenditure throughout the World, explicitly in developing nations as in India. The nation has encountered the flare-ups and epidemics of numerous infectious diseases. India, being a nation of outrageous geo-climatic decent variety, faces a steady danger of rising and reappearing viral contaminations of public wellbeing significance. At a fundamental level, rising contaminations can be characterized as those maladies whose frequency has been seen as expanded within late decades or which have taken steps to increase in future. Natural habitat demolition because of unplanned urbanization has put people at increasing contact with animals and arthropod vectors of viral diseases. Such communications have been one of the significant reasons for expanded human vulnerability to infections by novel pathogens, without distinctive immunity.

WHO reports reveal that, the source of existing and emerging infectious diseases (around 60 % and 70% respectively) in humans is zoonotic, with two-third originating in wildlife. [1]

Respiratory viral diseases, arbo-viral contaminations and bat-borne viral contaminations embody three significant classes of recent viral infections. Viral pathogens are known to cause outbreaks that have scourge and pandemic potential. At present Coronavirus (nCOVID-19) represents one of the life threatening complications in this category. [2]

Introduction:

Coronaviruses (CoVs) typically result in respiratory and enteric contaminations affecting the two creatures that is animal and people. Coronaviruses (CoVs) have a zoonotic cause from bats, aves and warm blooded creatures (most likely transmitted from bats or another host). Inadvertent research center interceded transmission may likewise be considered. [3] COVID-19 have a place with the family Coronaviridae and the order Nidovirales; [4] further separated into four genera based on protein groupings named Alpha, Beta, Gamma and Delta-coronavirus [5].

The 2019 novel CoV (SARS-CoV-2) is the most up to date expansion to human CoVs (HCoVs) that incorporate 229E, OC43, HKU1, NL63, rose in 2019 in Wuhan, China; staying two being extreme intense respiratory disorder (SARS) CoV flare-up in 2002, and Middle East respiratory condition (MERS) CoV outbreak in 2012. HCoV 229E and NL63 have a

place with Alpha-coronavirus; others are individuals in the family of Beta-coronavirus. At present these four HCoVs are tainting human populace around the world with high pace of mortality since Novel COVID-19 shows up exceptionally transmissible from human to human. [6-7]

In India, the first laboratory affirmed disease by SARS-CoV-2 was accounted for on January 30, 2020. This is the first report from India recognizing the SARS-CoV-2 infection utilizing TEM directly in a throat swab specimen affirmed by PCR.

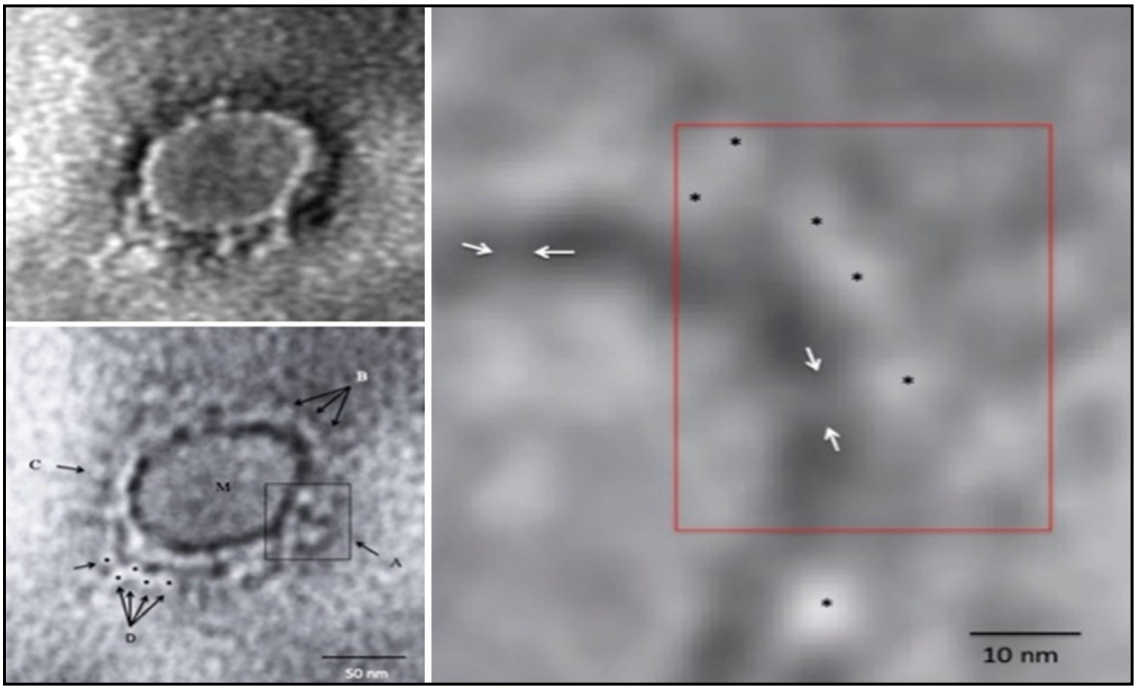

Figure 1. Transmission electron microscopy imaging of COVID-19. (A) A negative recolored COVID-19 molecule indicating morpho-demonstrative. (B) Defocussed picture of a similar molecule settling the virus envelope glycoprotein morphology in better subtleties. The boxed region A shows a tetramer-like total of four unique peplomers, bolts appeared by B show a progressively conventional morphology of coronavirus surface projections. M demonstrates the grid of the virus molecule. C shows an distinct 'peplomer head' with negative stain outline. The territory D is fascinating as conceivable direct projections could be imaged. Five particular peplomers could be imaged as appeared by the bolts. (C) A profoundly amplified handled picture for pixel amendments shows a particular proof of direct 'tail' interfacing the peplomer to the virion surface. The peplomers are appeared with bullet and the tail with a bolt. Amplification bars are incorporated with the micrographs. [8]

Genetics Configuration:

Hereditary material of HCoVs is a positive strand of RNA. The genome of COVID-19 offers about 96% replica from the bat coro-navirus BatCoV RaTG13(Rhinolophus affinis bats).[9] The extension of hereditary variety among coronaviruses and their resulting capacity to cause malady in people is mostly accomplished through tainting animals, which serve as intermediate hosts, sustaining recombination and mutation incidents. [10]

Recently, this novel CoV has been affirmed to utilize a cell passage receptor, (Angiotensin Converting Enzyme) ACE2. Its essential physiological role is in the development of angiotensin, a peptide hormone which primarily works on cardio-vascular system and controls vasoconstriction and circulatory strain. [11-13]

COVID- 19 is capable of transmitting among different host species via shifting tropism and variable receptor targeting. These characteristics are mediated by changes in the receptor binding domain (RBD) of the spike surface glycoprotein [14-15]. Their spike protein is comprised of S1 and S2 subunits, which are responsible for host receptor recognition which directly binds to the peptidase domain (PD) and membrane fusion, respectively [16- 18].

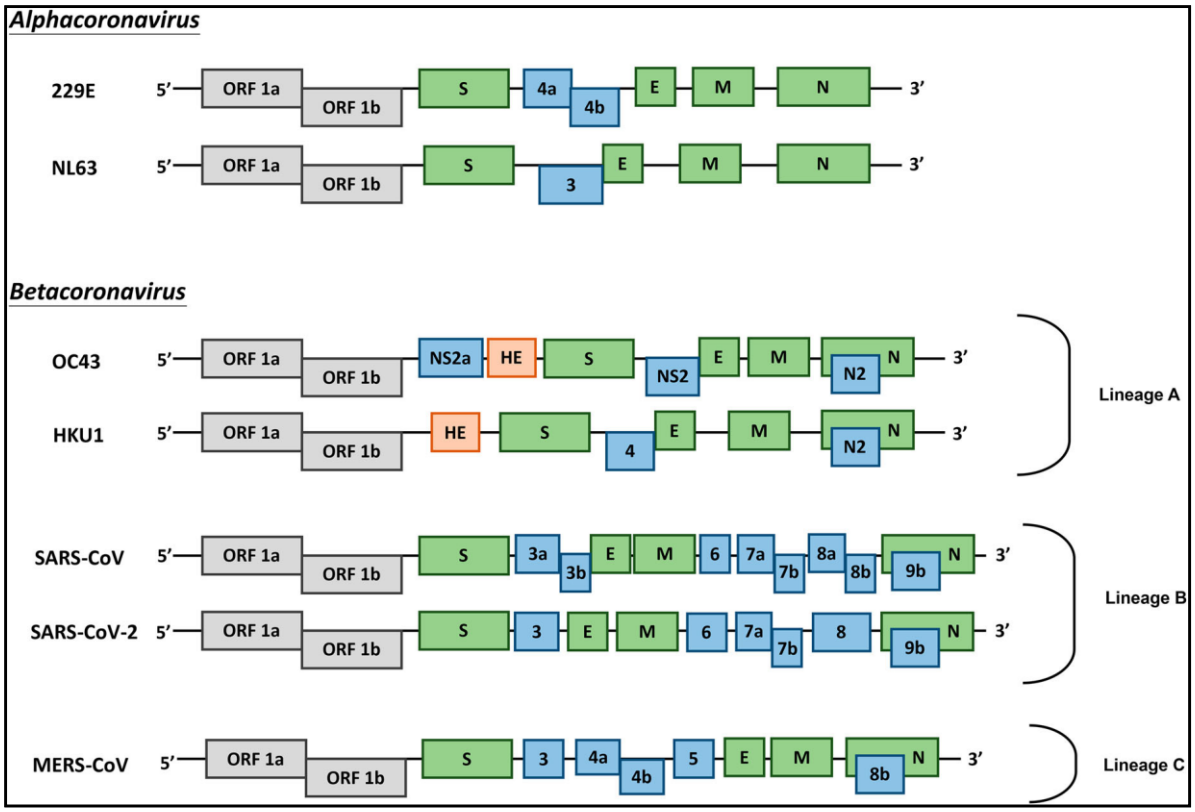

Figure 2. Genome association of HCoVs. Schematic chart of seven known HCoVs is appeared. The genes encoding basic structural proteins spike (S), envelope (E), membrane

(M), and nucleocapsid (N) are in green. The gene encoding haemagglutininesterase (HE) in lineage A of betacoronaviruses is in orange. The genes encoding embellishment proteins are in blue. [19]

Spike protein is a basic viral component that helps in the connection and infection disguise to the host cell. An immense measure of host cell receptors are focuses for viruses, including the cell surface GRP78. Hindering the communication that happens between the COVID-19 spike protein and the host cell receptor GRP78 would most likely diminish the pace of viral infection.[20]

Moreover, a vaccine for COVID-19 spike protein would probably forestall viral disease. The present in silico viewpoint proposes the presence of a COVID-19 spike protein-GRP78 restricting site, therefore establishing the road map for drug designers to create reasonable inhibitors to prevent the binding and henceforth the disease. Future work including the elements of GRP78 and the exploratory approval is required to propose intense peptidomimetic inhibitors. [21]

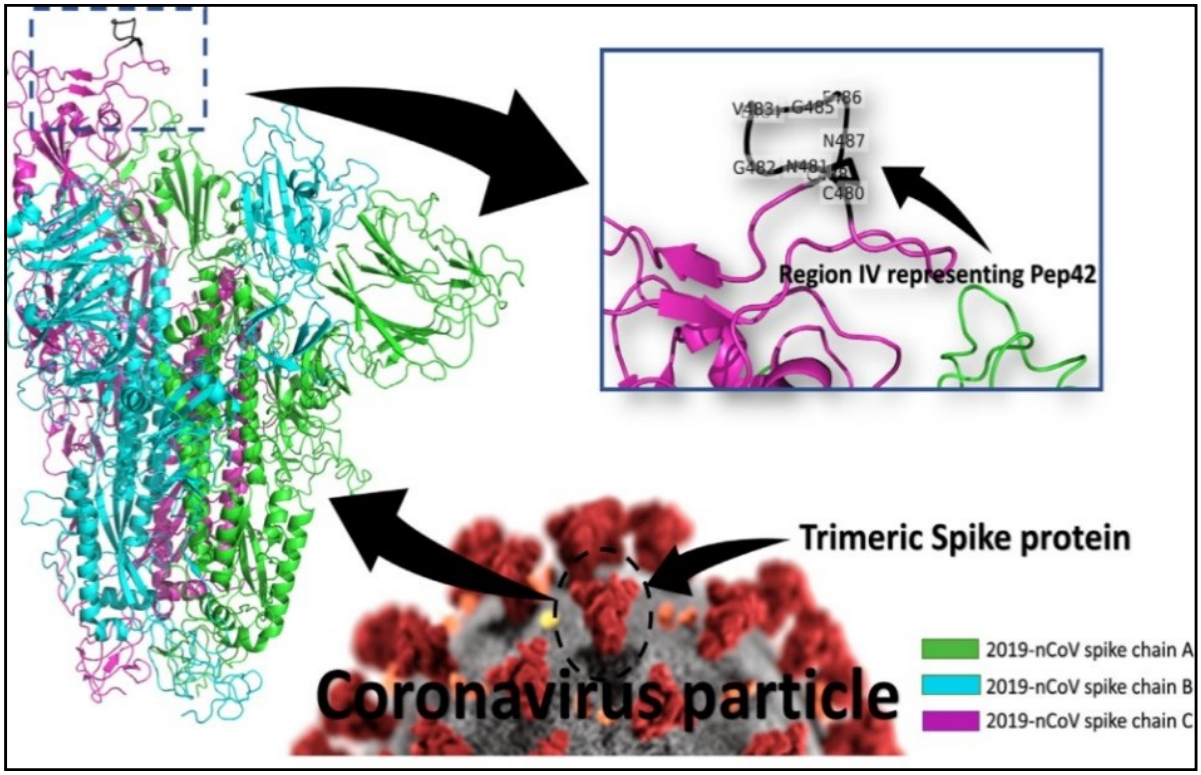

Figure 3. The structure of the spike protein model of COVID-19 in its homo-trimmer state (hued animation). Two chains, A (green) and B (cyan) are in the shut compliance, while chain C (fuchsia) is the open setup that makes it ready to perceive the host cell receptor.

Locale IV of the spike (C4 80-C4 88), which is proposed as the acknowledgment site for cell-surface GRP78, is appeared in the black animation in the extended board. [22]

In India, initial three instances of SARS-CoV-2 with a movement history from Wuhan, China, were indicated practically complete (29,851 nucleotides) genomes of case 1, case 3 and a divided genome for case 2 were gotten. The successions of Indian SARS-CoV-2 however not indistinguishable indicated high (~99.98%) character with Wuhan seafood market pneumonia infection (accession number: NC 045512). Indian SARS-CoV-2 groupings demonstrated two changes 408 Arg→Ile and 930 Ala→Val in the spike protein contrasted with the Wuhan Hu-1 succession. The changes were additionally mapped on the spike protein model of the Indian sequence. Omission of a three-nucleotide stretch, encoding tyrosine buildup at position 144, of the spike gene was likewise seen in the Indian SARS-CoV-2 from case 1 when contrasted with the remaining SARS-CoV-2 sequences.

Phylogenetic investigation indicated that the Indian successions had a place with various groups. Anticipated straight B-cell epitopes were seen as amassed in the S1 space of spike protein, and a conformational epitope was recognized in the receptor-restricting area. The anticipated T-cell epitopes indicated wide human leucocyte antigen allele inclusion of A and B super sorts overwhelming in the Indian populace [23].

Phylogenetic varieties have likewise been seen in COVID positive patients, who had originated from Italy, Iran and other European nations. RT-PCR conclusion has affirmed some division of changes to one another in the genome of the patients coming from various nations. [24]

Source And Spread:

A few current examinations based on meta-genomic sequencing have proposed that a gathering of jeopardized little warm blooded creature known as pangolins (Manis javanica) could likewise harbor tribal beta-CoVs identified with SARS-CoV-2 [25]. However, as of now there is no proof on the side of an immediate pangolin root of SARS-CoV-2 because of the succession uniqueness between SARS-CoV-2 and pangolin SARS-CoV-2-related beta-CoVs. The transformative pathway of SARS-CoV-2 is bat based on hereditary qualities. [26-27]

It has been accounted for that a bat CoV named ARCoV.2 (Appalachian Ridge CoV) identified in North American tricolored bat showed cozy relationship with HCoV-NL63 [28]. Then again, HCoV-229E was hereditarily identified with another bat CoV, named Hipposideros/GhanaKwam/19/2008, which was recognized in Ghana [29], while camelids have additionally been suspected as its middle host [30-31]. For clearness, the present information on creature roots of known HCoVs is summed up in Figure 4.

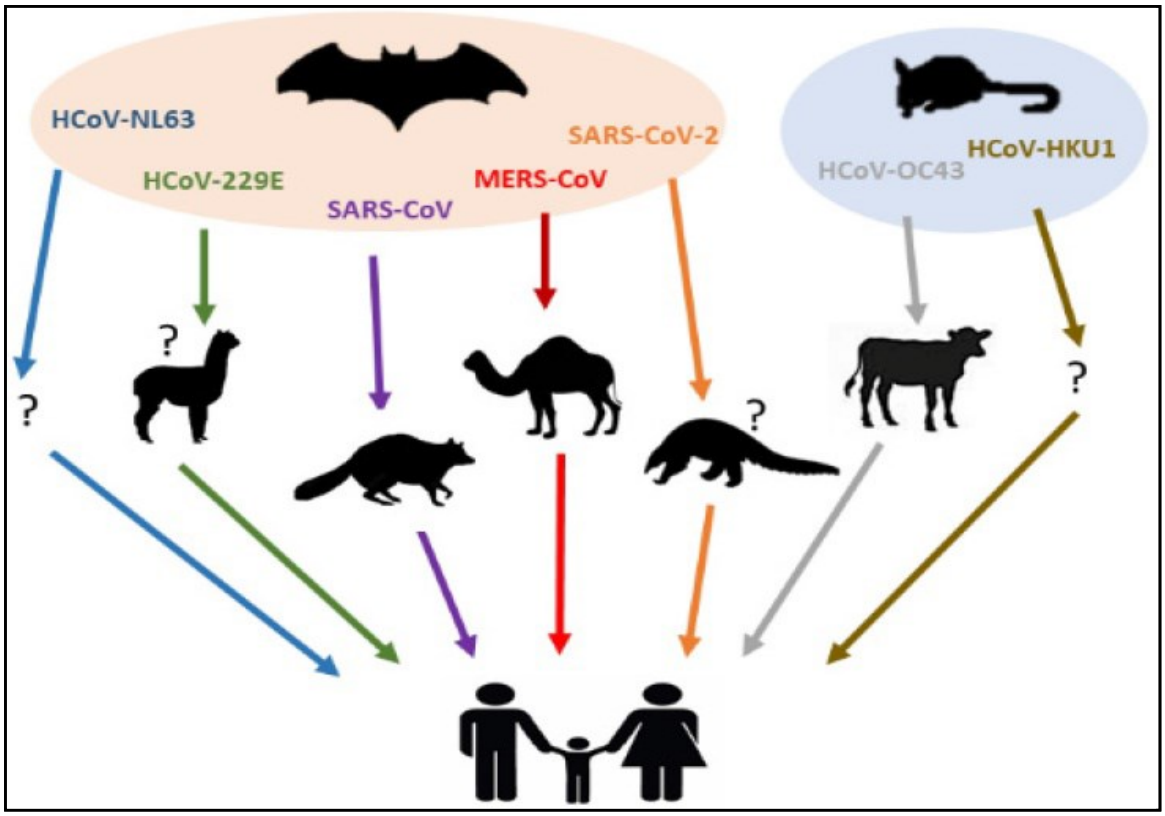

Figure 4. Creature hosts of HCoVs. Blue, green, purple, red, orange, dim, earthy colored bolts depict the transmission of HCoV-NL63, HCoV-229E, SARS-CoV, MERS-CoV, SARS-CoV-2, HCoV-OC43 and HCoV-HKU1 from their characteristic hosts (bats or rodents) to the middle hosts (camelids, civets, dromedary camels, pangolins or bovines), and in the end to the human populace. No solid proof exists on the intermediated host(s) of HCoV-NL63 and HCoV-HKU1, which was appeared as a question mark (?).[32]

The decent variety of bat CoVs gives plentiful chances to the rise of COVID-19. In this sense, bat CoVs serve as the genetic supply of SARS CoV-2. Furthermore, fast transformation and hereditary recombination likewise drive nCOVID-19 advancement and fill in as two significant strides in this process.[33-35] For instance, the obtaining or loss of

novel protein coding qualities can possibly radically change viral phenotypes. Among SARS-CoV embellishment proteins, ORF8 has been believed to be significant in adjustment to people, as SARS-CoV-2 related bat infections were disconnected however found to encode dissimilar ORF8 proteins. [36-37]

Last but not least, the development of novel COVID-19 is additionally determined by the choice in their repository hosts. Asymptomatic or just gentle manifestations were identified when bats were tainted with CoVs, showing the shared adjustment among CoVs and bats [38-39]. It created the impression that bats are all around adapted to CoVs anatomically and physiologically. For instance, defects in the initiation of pro-inflammatory reaction in bats proficiently lessen the pathology activated by COVID [40]. Furthermore, the characteristic executioner cell action in bats is stifled due to up regulation of inhibitory natural executioner cell receptor NKG2/CD94 and low articulation level of significant histocompatibility complex class I atoms [41-42].

Recent, COVID-19 disease may be begun from the contact among people and civets in the market (China), shutting wet markets and executing civets in that could have successfully finished the SARS scourge. By the same reasoning, pangolins ought to be expelled from wet markets to forestall zoonotic transmission, taking into account the revelation of numerous heredities of pangolin beta-CoVs firmly identified with SARS-CoV-2. In any case, regardless of whether and how SARS-CoV-2 is transmitted to people through pangolins and different well evolved creatures stay to be explained in future examinations. [43]

The way of life of eating wild creatures in certain spots of China should be deserted to diminish superfluous contact among people and creatures. Albeit bats have numerous highlights that favor the spreading of infection, the possibility for people to be in contact with bats and other untamed life species can be limited if individuals are taught to avoid them. With the trials of SARS, MERS and COVID-19, a superior readiness and reaction plan should be set up. [44-46]

An asymptomatic bearer of SARS-CoV-2 was accounted for in the first investigation of a family cluster [47]. Transmission of SARS-CoV-2 from an asymptomatic transporter to close contacts was later recommended, yet this has hence been tested. Notwithstanding, regardless of whether relatives and close contacts could be contaminated by the index patient in the pre-indicative window period as claimed, it is as yet deserving of a huge concern. Assumed

transmission of SARS-CoV-2 from an asymptomatic carrier to relatives has recently been recorded [48].

Second, the transmission of SARS-CoV-2 from asymptomatic carriers and pre-symptomatic patients could be even rare, if their viral burdens are low and infection shedding is not significant and for those with no upper respiratory clinical issue [49].

Hypothetically, asymptomatic transporters may emerge when have antiviral safeguard is either solid or decoupled. At the point when the immune response effectively confines however could not totally hinder SARS-CoV-2 replication, asymptomatic shedding may happen. [50]

SARS-CoV-2, the operator of COVID-19, basically spreads by beads from mucous layers (eyes, nose, and mouth), is effectively transmissible (reproduction number R0: 2–3, which means one contaminated individual, could taint three), and can spread through asymptomatic or insignificantly symptomatic people [51]. SARS-CoV-2 fundamentally spreads by coughing, sniffling, droplet inward breath, and physical contact. SARS-CoV-2 has been identified in salivation tests, making spit a potential transmission course for COVID-19 [52]. It has a middle hatching time of five-to-six days and a time of infectivity stretching out from two days before indication beginning to about fourteen days after ailment beginning in extreme cases. [53-54]

Symptoms:

SARS-CoV-2 has hereditary features vary fundamentally from those of serious intense respiratory condition coronavirus (SARSCoV) and Middle East respiratory disorder coronavirus. It is principle clinical introductions are fever and respiratory manifestations. Notwithstanding, a few patients may likewise give neurologic signs, for example, cerebral pain, queasiness, and regurgitating or loss of smell, taste and even encephalitis. [55]

The SARS-Cov-2 first overwhelmingly contaminates lower aviation routes and ties to ACE2 on alveolar epithelial cells. COVID-19 is intense inducers of inflammatory cytokines. The "cytokine tempest" or "cytokine cascade" is the proposed mechanism for organ harm. The virus enacts immune cells and instigates the discharge of fiery cytokines and chemo-kines into pulmonary vascular endothelial cells. The primary clinical signs of COVID-19 are fever

(90% or more), cough (around 75%), and dyspnea (up to half). A little yet noteworthy subset has gastrointestinal manifestations. [56-57]

Laboratory assessment shows that absolute quantity of leukocytes, neutrophils and lymphocytes decline in many patients, while CRP increases significantly and pro-calcitonin is typically normal. The principle signs on CT are inconsistent/punctate ground glass opacities with a solitary flap or various projections involvement. [58]

Susceptibility To Covid- 19:

The danger of death from COVID 19 seems to be in those matured greater than 40 years and presumably connected to other severe medical history, specifically prior medical problems including heart ailment, respiratory scatters, diabetes, cancer and dementia. [59]

Besides, a few authors detailing early perceptions from China, seem to recommend that a potential cytokine storm or fulminant myocarditis might be pre-determinants of danger of death from this sickness; with raised heart troponin, myoglobin, C-receptive protein and Interleukin-6 being indicators of danger of death. As the proof advances, are these markers which we ought to be routinely be surveying in affirmed cases of COVID 19. [60]

Likewise it is by all accounts that information are developing that kids are probably going to give milder indications than older adults, with an ongoing research recommending that 13% of youngsters who screen positive are asymptomatic, 42% have mellow upper respiratory tract symptoms, 45% exhibit regular (adult) manifestations, and no kid has extreme or critical highlights. [61]

Diagnosis:

The disease rate is considerably thought little on the grounds that a noteworthy extent of COVID-19 patients have not been affirmed by polymerase chain reaction (PCR), due to the fact numerous patients, particularly more youthful ones, have just scarcely any symptoms if any, and numerous patients with manifestations are not tested. It has been estimated that the absolute number of COVID-contaminated individuals is around five times higher than the official measurements. This inclination must be considered when deciphering any COVID-19 statistics. [62]

In a study, synthetic or artificial intelligence (AI) using a 3 dimensional profound gaining knowledge of model is reported tremendously touchy and particular for the prognosis of COVID-19. This model is structured on proof based totally and realistic measures to compliment, and include an amalgamation of the modern-day technological advances on rising approaches to enhance control and especially determination of this rising pandemic (Figure 5). [63-64]

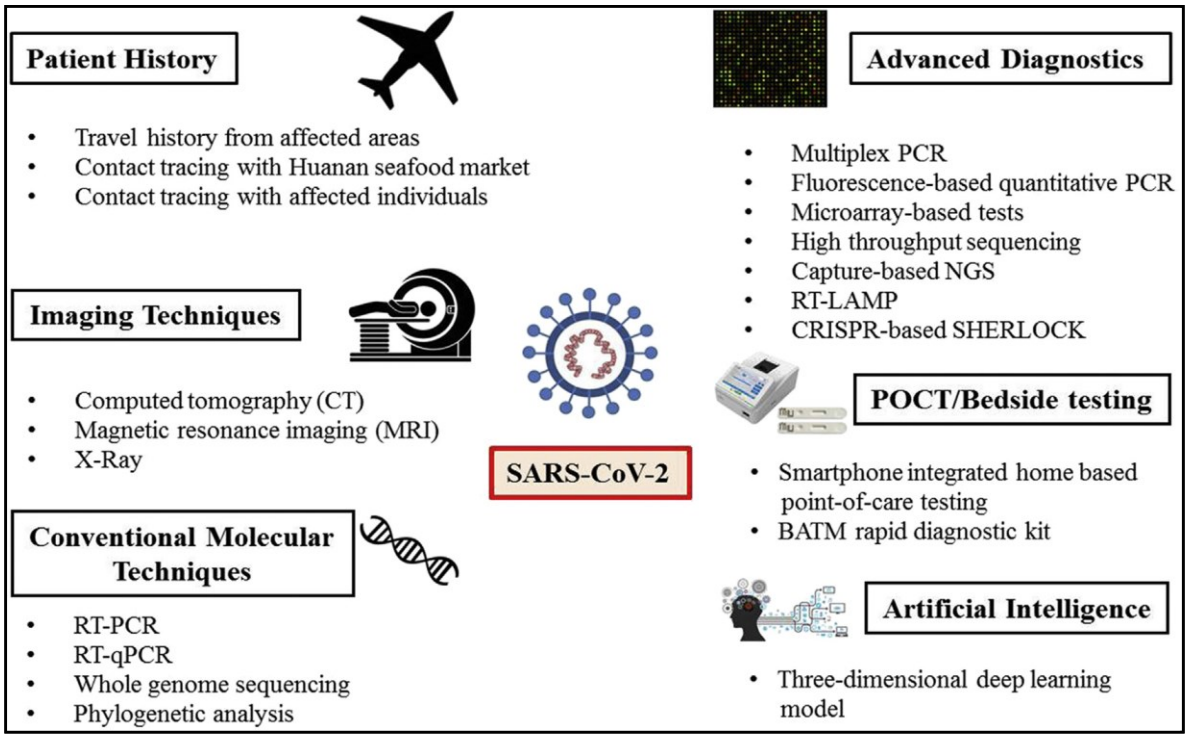

Figure 5. Significant check-points identified with the current innovative advances on developing ways to deal with improve control and especially diagnosis of the SARS-CoV-2/COVID-19 pandemic NGS (Next Generating Sequencing); RT-LAMP (Reverse Transcriptional Loop-Mediated Isothermal Amplification); CRISPR-based SHERLOCK (Specific High Sensitivity Enzymatic Reporter UnLOCKing); POCT (Point-Of-Care Testing)

There are barely any accessible methodologies that can recognize SARSCoV-2, from the standard research facility tests to the quick symptomatic tests with incredible application capacity to help decreasing the labor of recurring laboratory test.

Antibody Based Protein Level Detection: This test is led with patient's serum to check if the patients have the precise counter acting antibody against SARS-CoV-2's antigen. Since

this technique is certifiably not an immediate identification of SARS-CoV-2 infection, there can be a vulnerable side when the samples are detected as negative.[65-66]

Nucleic Acid Amplification Tests (NAAT): The significant research assay to affirm whether patients are tainted with SARSCoV-2 or not is through the nucleic acid amplification tests (NAAT), for example the real-time reverse transcription polymerase chain reaction (rRT-PCR). To painstakingly affirm the disease, three areas of the SARS-CoV-2 RNA successions are chosen for the measure: coding area for spike protein, ORF1, and ORF8. [67-69]

Numerous molecular demonstrative probes have been allowed by Emergency Use Authorization (EUA) and Food and Drug Administration (FDA) to recognize SARS-CoV-2 positive patients. Three significant molecular probes are as followed: -

The Xpert SARS-Cov-2 Xpress Assay: It is a sub-atomic in vitro indicative test using broadly practiced real time RT-PCR intensification tool to identify the nucleo-capsid quality (N2) and the envelope quality (E) in upper respiratory samples. [70-71]

The ID NOW COVID 19 Assay: It is a fast atomic in vitro analytic test using isothermal nucleic acid amplification technology to recognize the RNA-dependent RNA polymerase (RdRp) gene fragment of the SARS-CoV-2 virus. [72]

The Eplex Assay: It is an in vitro diagnostic test that objectives the N gene of SARS-CoV-2 and utilizations combined electro wetting technology for the extraction, intensification and identification with the help of competitive DNA hybridization and electrochemical probes. [73]

In a clinical assessment, it was found that the Xpert Xpress had the most reduced constraint of detection that is highly sensitive (100% recognition at 100 copies/mL), accompanied by using the ePlex (100% detection at 1,000 copies/mL), and the ID NOW (20,000 copies/mL). The Xpert Xpress likewise had most elevated positive percent agreement (PPA) when contrasted with the reference standard (98.3%) alongwith ePlex (91.4%) and ID now (87.7%). [74]

Clusters of Regularly Inter-Spaced Short Palindromic Repeats (CRISPR) Technique: Meanwhile, researchers around the globe are constantly searching and exploring innovative

strategies for the identification of SARS-CoV-2. For instance; a dynamic gene altering probe CRISPR method has been applied to effectively distinguish manufactured SARS-CoV-2 RNA successions. [75-76]. More recently, a completely novel approach that combines a unique RNA amplification (reverse transcription enzymatic recombinase amplification, RT-ERA) and a fluorescence resonance energy transfer (FRET)-based probe has proposed. [77]

In India, three continuous RT-PCR assays are practiced [based on the RNA dependent RNA polymerase (RdRp) gene, envelope (E) gene and nucleo-capsid (N) gene], which are best for spotting COVID-19 with the aid of in vitro transcribed (IVT) RNA for SARS-CoV-2; targeting E gene, while the corroborative RdRp test utilized purged RNA of SARS-coronavirus Frankfurt 1 strain as positive control . [78]

Clinical Management:

There are no precise treatments endorsed by the World Health Organization (WHO), the Centers for Disease Control and Prevention (CDC) for extreme intense respiratory syndrome coronavirus SARS-CoV-2, the infection that causes coronavirus malady 2019 that is COVID-19. A few agents are being utilized under clinical trial and strict protocol dependent regimen to validate in vitro activity against SARS-CoV-2 on confined medical experience. Till now, viability has not been built up for any medication therapy. [79]

Comprehension of the treatment of sufferers with COVID-19 is hastily evolving. Drug regimen data will keep on developing with respect to pharmacologic treatment for SARS-CoV-2 as new clinical information will get approval.

A list of currently used medicines is followed:

S. No.	Drug	Class	Mode of Action	Safety Concern	References
01	Chloroquine	Anti-Malerial	Inhibition of viral enzymes; ACE2 cellular receptor inhibition	Risk of cardiac-arrhythmias; Caution in patients with G6PD deficiency, Caution in diabetics	80-82
02	Hydroxy chloroquine	Anti-Malerial	Same as Chloroquine	Same as Chloroquine	83-86

S. No.	Drug	Class	Mode of Action	Safety Concern	References
03	Lopinavir; Retonavir	HIV Protease Inhibitor	Replication enzyme (M^{Pro}) inhibitor	Risk of cardiac arrhythmias; Caution in patients with hepatic disease or hepatitis	87-90
04	Remdesivir	Anti-Viral	RNA dependent RNA- polymerase inhibitor	Contraindicated in pregnancy according to animal study	91-95
05	Favipiravir	Anti-Viral	RNA dependent RNA- polymerase inhibitor	Contraindicated in pregnancy according to animal study	96-99

Table 1. List of medicines

Supportive Therapy:

S. No.	Drug	Class	Mode of Action	References
01	Azithromycin	Macrolide	Immunomodulator Cytokine IL- 8 inhibitor	100-102
02	Siltuximab	Monoclonal Antibody	Interleukin IL-6 receptor-inhibitor	103-105
03	Leronlimab	Monoclonal Antibody	Immunomodulator Cytokine release syndrome	106-108
04	COVID-19 Convalescent Plasma	Plasma Antibody	Immunomodulator	109-112

Table 2. List of supportive medicines

The main stay of all information about COVID-19 is to develop effective treatment. Recently, angiotensin-converting enzyme 2 (ACE2) has been demonstrated to be a utilitarian receptor for SARS-CoV-2 to enter target cells. It is observed that angiotensin receptor blockers (ARBs) and an ACE inhibitor (ACEI) up directed ACE2 articulation in animal examines, the worry may emerge with respect to whether ARBs and ACEIs would build the grimness and mortality of COVID-19. Then again, animal data proposed a potential defensive impact of ARBs against COVID-19 pneumonia in light of the fact that an ARB forestalled the exacerbation of intense lung injury in mice tainted with SARS-CoV-2, which is firmly

identified with SARS-CoV-2. Critically, in any case, there is no clinical or test proof supporting that, ARBs and ACEIs either enlarge the weakness to SARS-CoV-2 or bother the seriousness and consequences of COVID-19 at present. Until further information are accessible, it's miles encouraged that ARB and ACEI medications be endured for the remedy of patients with cardiovascular disease and hypertension, especially the ones at high risk, in step with guideline-directed clinical therapy based on the currently available evidence. [113-115]

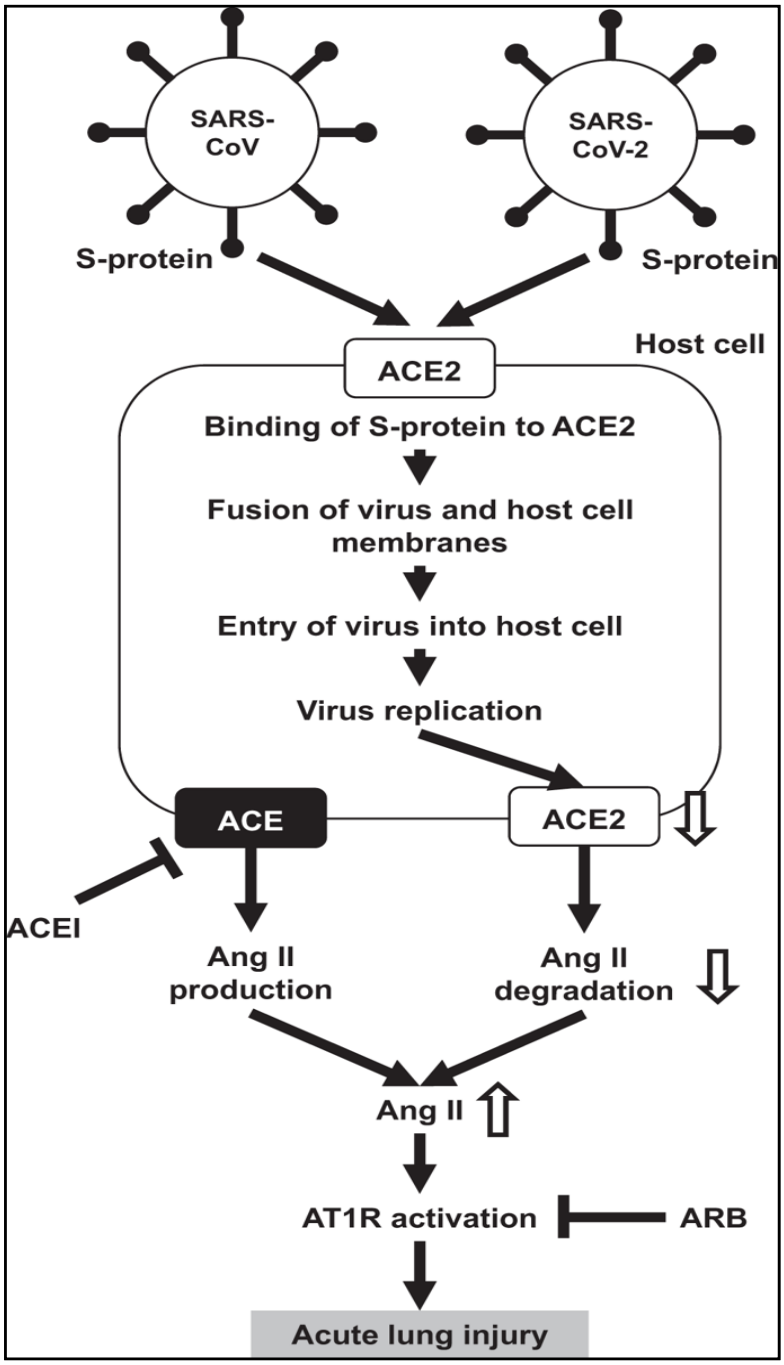

Figure 6. Conceivable plan of the relationship of ACE2, angiotensin II, and AT1R and intense lung injury of SARS and COVID-19. Ang II, angiotensin II; ACE, angiotensin-

changing over compound; ACE2, angiotensin-changing over chemical 2; ACEI, angiotensin-changing over catalyst inhibitor; AT1R, angiotensin II type-1 receptor; ARB, angiotensin II type-1 receptor blocker; SARS-CoV, serious intense respiratory disorder coronavirus; SARS-CoV-2, extreme intense respiratory condition coronavirus 2; S-protein, spike-glycoprotein.[116]

As of late, an Italian patient of COVID-19 is treated in Sawai Man Singh (SMS) Hospital, Jaipur India by giving a combination of lopinavir (200 mg) and ritonavir (50 mg) two times per day. In addition, the patient was additionally given a dose of oseltamivir and chloroquine medication. [117]

Asymptomatic 2019-coronavirus ailment tolerant (ten patients) with normal radiography all through showed up in an examination. Furthermore, it is observed that Lopinavir positively affects 2019-coronavirus ailment patients. Eosinophil count is noticed as a crucial bio-indicator of COVID-19 progression. Expanding eosinophils might be a pointer of COVID-19 improvement. The COVID-19 patients may profit by continued lopinavir administration. [118]

While generally speaking death rate is probably going to be lower than the present appraisals, as the pervasiveness of somewhat mildly symptomatic cases still cannot seem to be clearly characterized, COVID-19 has now become an obvious crisis for human civilization. There are no authorized vaccines or approved antiviral drug treatment to secure or treat against COVID-19. Antiviral treatment that viably captures infection and useful vaccines that ensure against extreme COVID-19 is along these lines critically required to meet medical and general wellbeing needs. An intermingling among medication and vaccine for Covid-19 is the harnessing of the invulnerable reaction to SARS CoV-2. To address these issues, different gatherings have made striking steps in bringing new therapeutics and vaccines into clinical advancement within a brief time-frame. [119-120]

Indian Status Report:

India is currently in a conclusive period of the reaction. As on account of polio, in fighting COVID-19 as well, reconnaissance is assuming a focal role. In like manner, in line with the government, WHO has additionally ventured up the help in fortifying continuous surveillance and reaction at state, region and block levels; group control exercises that is containment or

isolation zone; reinforcing ongoing information assortment exercises; and quickened usage of the national Integrated Health Information Platform.

As on 2 August 2020, 08:00 IST there were 567,730 Active Cases 1,145,629 Cured/Discharged, 1 Migrated and 37,364 Deaths in India. India's Case Fatality Rate (CFR) is its lowest at 2.15% since 1st Lockdown; Total recoveries nearly 11 lakh; [121]

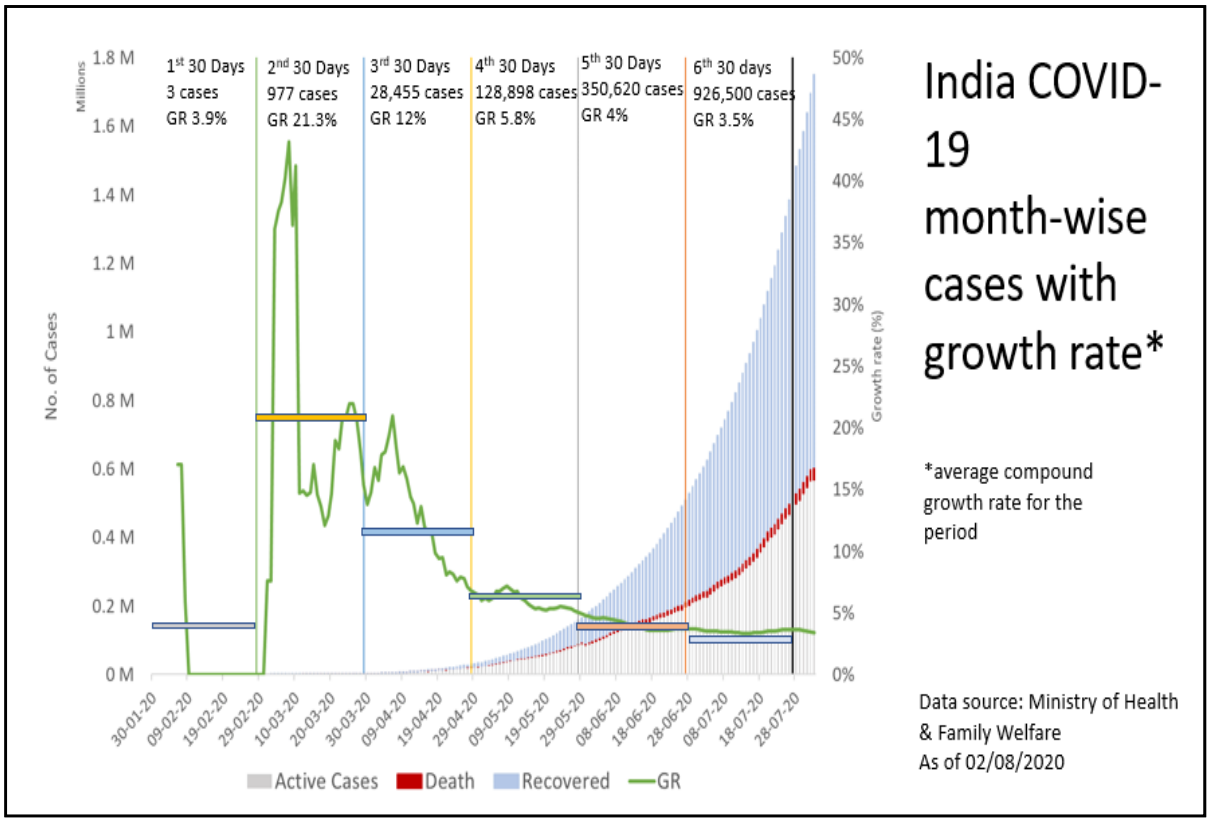

Figure 7. Graphical presentation of COVID-19 medical status in India.

Conclusion:

COVID-19 pandemic is a worldwide health crisis. It has presented new difficulties to the worldwide research fraternity. Broad research is required for the advancement of a vaccine for the avoidance of Coronavirus disease. There is a dire requirement for early production and assembling of the basic things like individual defensive hardware (personal protective equipment), medicines, and ventilators to battle this pandemic. All measures to keep a social separating by the public must be guaranteed by maintaining a strategic distance from social-traditional, religious programs and festivals etc during this pandemic. Alongside these, healthcare measures to manage COVID-19 pandemic, there is likewise an unavoidable

necessity for the research to improve the worldwide economy, which has taken a huge beating and is probably not going to recoup sooner rather than later.

Coronavirus (COVID-19) pandemic is developing exponentially in the entire world. Researchers, technologists, specialists and other healthcare laborers are working day and night on the evolution of vaccines and medicines to control and treat this infection. SARS-CoV-2 is the name of the infection liable for causing COVID-19 malady, which is exceptionally irresistible and deadly. With exponentially expanding diseases, proportionate fatalities are being accounted for both from developed and underdeveloped nations. Starting today, about 10 million individuals over the world have been accounted for contaminated with this infection, and in excess of 4 lakh individuals have kicked the bucket of this sickness. Consequently, there is a pressing prerequisite for directing scholastic research on a several aspects of this exceptionally infectious sickness, to discover compelling methods for control and treatment of the illness, for now and in future. We have recognized a few open doors for scholastic research pertaining to COVID-19 and have likewise given recommendations to contain forestalled and treat this viral disease.

With the assistance of academic research, there is a requirement for a superior comprehension of the COVID-19 and its socio-economic consequences on society. The future research will be multi-disciplinary and trans-national. We see another influx of research in the natural and the clinical sciences for the prosperity of the human advancement. This review will surely help to achieve and understand the above mentioned goals and tasks respectively.

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4. COVID-19 And Face Protection Masks

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Introduction:

On December 31 of 2019, the Chinese authorities sent an alert message to the World Health Organization about the outbreak of a strange strain of coronavirus (then named as named SARS-CoV-2) causing multiple illness. Subsequently, on 30 January 2020, WHO declared the outbreak a Public Health Emergency of International Concern and then as a pandemic on 11 March 2020. A disease is declared as an epidemic when an outbreak of disease spreads over a wide area, affecting many individuals at the same time to become ill, while the epidemic can potentially become a pandemic when wider geographical areas and significant (or exceptionally high) proportion of the population are affected. The first scenario suggests the spreading of viruses in its pathogenic form from a non-human host to human and causing an epidemic, while the second scenario envisages the spreading of viruses, in its non-pathogenic version from animals to humans and subsequently evolving into pathogenic state.

Viruses - Cause of Concern:

In biology, viruses are regarded as non-living, small infectious agents, which invade living cells (host), multiply inside those cells and causing damages (illness / diseases) to the hosts, e.g. animals, plants, human, bacteria and cause diseases [1]. The viruses are either intracellular (active form) or extracellular (inactive form), adapted to transfer the nucleic acid from one cell to another (Fig. 1). Classification of viruses are based on their (i) structure (simple – made up of nucleic acid and protein shell, complex – made up of nucleic acid, protein shell and lipoprotein envelope) and (ii) type of nucleic acid (DNA or RNA). The nucleic acid can be single or double stranded, protected by a shell containing proteins, lipids, carbohydrates, or their combinations [2, 3]. Occurrences of single-stranded DNA viruses are rare, while twofold stranded DNA viruses are commonly observed whereas in the case of RNA viruses, there are very few cases of twofold stranded RNA viruses and predominantly they are single-stranded.

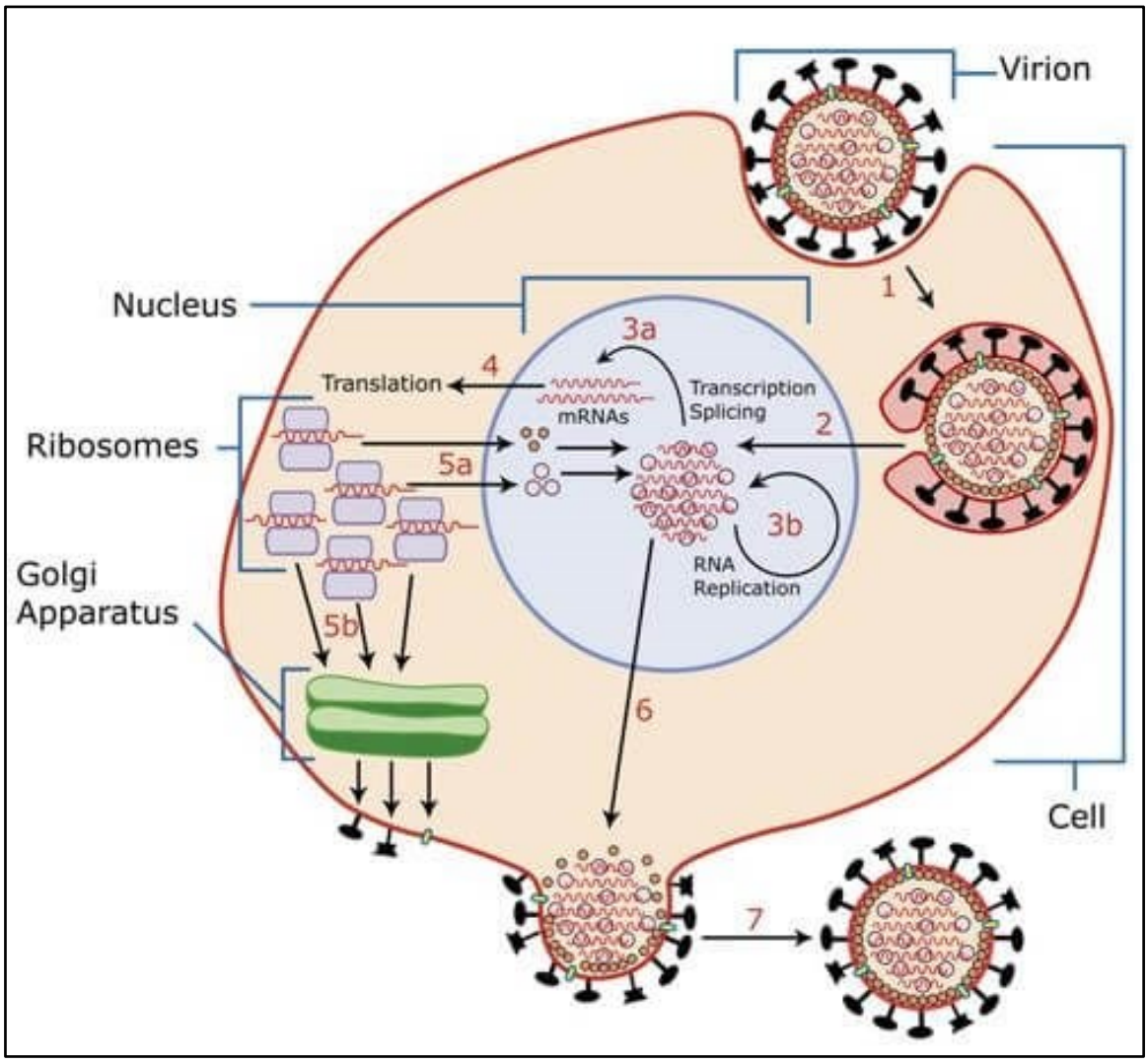


Fig. 1 Action of Virus in Host Cell

A virus attaches to a living cell and injects its nucleic acid into it where the nucleic acid binds to the ribosomes of the cell and stimulates them to produce viral proteins [1, 3]. Multiplication of the viral genome occurs through replication, resulting in a huge number of new copies of the viral RNA or DNA, i.e. new viruses. The host cells are damaged in this process and become no longer beneficial to the viruses, which makes the viruses to leave those cells and target new cells.

DNA Viruses Vs RNA Viruses:

Deoxyribonucleic acid (DNA), double-stranded molecules found in the nucleus, is the major storage for genetic codes that contains information for the functioning and advancement of all

living organisms. DNA virus instils the genetic code specifically to the membrane of the host DNA then with the help of RNA polymerase, the duplication happens in the nucleus and released during the lytic phase of the host cells (multiplication step) with the copies of infection. Since the specificity of the DNA viruses are detected at the transcriptional (constant) level, certain vaccines are effective throughout the years. Ribonucleic acid (RNA) that contains ribose sugar, is usually a single-stranded molecule, instilling the RNA to the host cell cytoplasm. Unlike DNA viruses which must always transcribe viral DNA into RNA to synthesize proteins, RNA can skip the transcription process [4]. DNA here acts as a pattern for RNA and transcribes it into viral proteins. Certain RNA viruses embed transcriptase enzyme that transfer RNA virus to DNA virus and combine with the host DNA thereby following the DNA replication process. Mutation is the major cause of the changes, by RNA polymerase, in the genetic code of the viruses and makes them unstable, replace the protein coat that can confuse the immune system [2, 4]. When RNA viruses attack the human living being, they infuse their RNA into the cytoplasm of the host cells, where RNA can be utilized to integrate proteins and frame the imitations (Fig. 2).

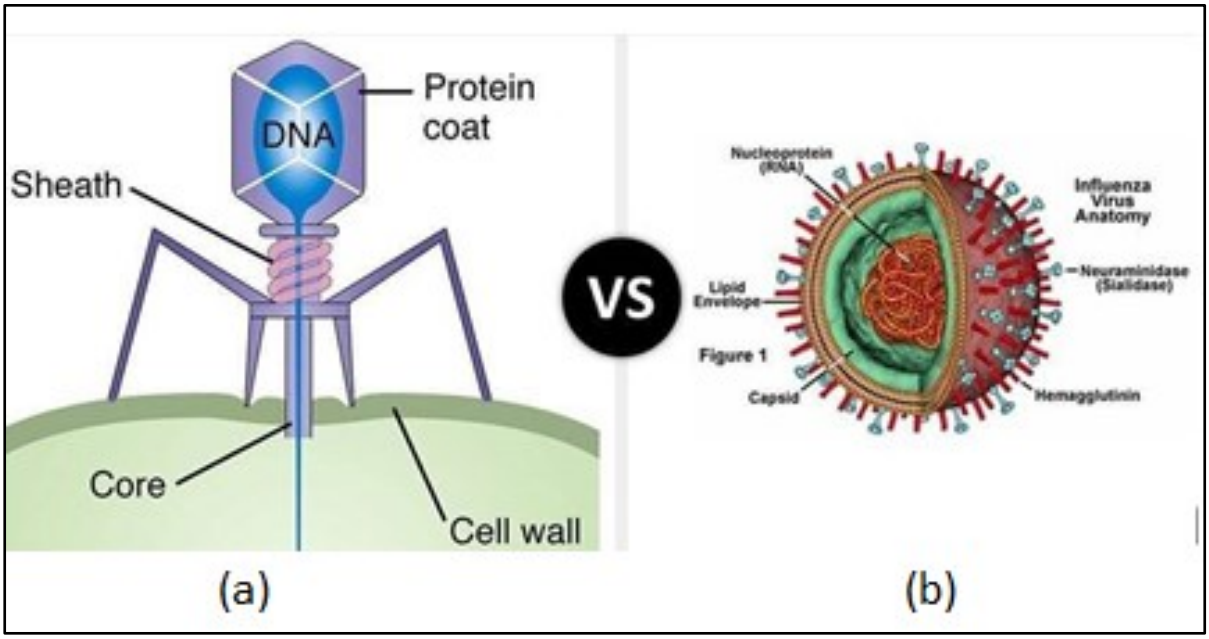


Fig. 2 Schematic Representation of (a) DNA and (b) RNA Viruses

In DNA viruses, there are two stages in the translation procedure first, the mRNAs (messengers) are made (alpha and beta mRNA) subsequently, gamma mRNAs and are interpreted into the cytoplasm, further leading to DNA replication. These stages can't be recognized in the RNA interpretation process of RNA viruses, which interpret mRNAs on

host ribosomes and make viral proteins instantly with higher transformation rates than DNA change rates [5]. This obviously results in faster communication of diseases in the case of those caused by RNA viruses.

Single-stranded RNA viruses that can be further ordered into negative-sense and positive-sense RNA viruses, depending on the sense or polarity of the RNA. Positive (or plus-strand) and negative (or minus-strand or anti-sense) sense RNA viruses are the two types of single-stranded RNA viruses classified based on the type of genome [6]. Both positive and negative sense RNA viruses are infectious and cause diseases in animals and plants. Positive-sense RNA viruses account for a large fraction of known viruses, including many pathogens such as hepatitis C virus, dengue virus, and SARS and MERS coronaviruses, as well as less clinically less serious, common cold.

Coronaviruses:

Coronaviruses are a group of viruses that can cause a range of symptoms including a running nose, cough, sore throat and fever, usually spread through direct contact with infected persons. Coronaviruses, name originating from Latin for crown-spikes on its surface, have helically symmetrical nucleocapsids (nucleic acid and surrounding protein coat), which is uncommon among positive-sense RNA viruses, but far more common for negative-sense RNA viruses.

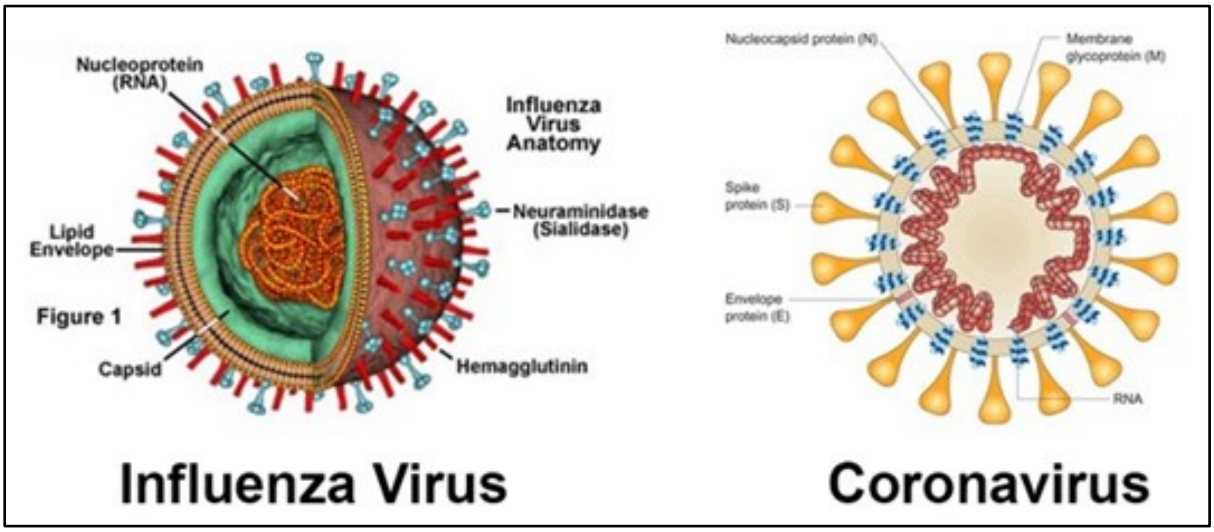


Fig. 3 Schematic Representation of Influenza and Corona Viruses

Human coronaviruses were first identified in the mid-1960s and there are four main sub-groups of coronaviruses, known as alpha, beta, gamma, and delta. Sometimes coronaviruses that infect animals can evolve, make people sick and become a new human coronavirus like MERS-CoV (the beta coronavirus that causes Middle East Respiratory Syndrome), SARS-CoV (the beta coronavirus that causes severe acute respiratory syndrome) and SARS-CoV-2 (COronaVIrus Disease 2019, or COVID-19). Including the newly identified form of the virus, there are a total of seven coronaviruses that can infect humans [1, 7, 8]. All the coronaviruses can be transmitted between humans through close contact. MERS, which was transmitted from touching infected camels or consuming their meat or milk, was first reported in 2012 in Saudi Arabia. SARS was first reported in 2002 in Southern China was thought to have spread from bats that infected civets. Since the virus, nCov 2019, first popped up in Wuhan (China) among the people who had visited a local Huanan seafood market, it is hoped to have spread from animal to humans. In a recent study, the researchers compared the 2019-nCoV genetic sequence and found close relationship (88% of their genetic sequence) with the viruses that originated in bats.

Invariably, many of us get infected due coronaviruses in certain stages with mild to moderate symptoms, respiratory tract illnesses including pneumonia and bronchitis. These viruses are common amongst animals worldwide and rarely, coronaviruses can evolve and spread from animals to humans, the typical cases include MERS and SARS-Cov. It is unclear how the new coronavirus compares in severity, as it causes severe symptoms and death in some patients while causing only mild illness in the case of others (Fig. 4).

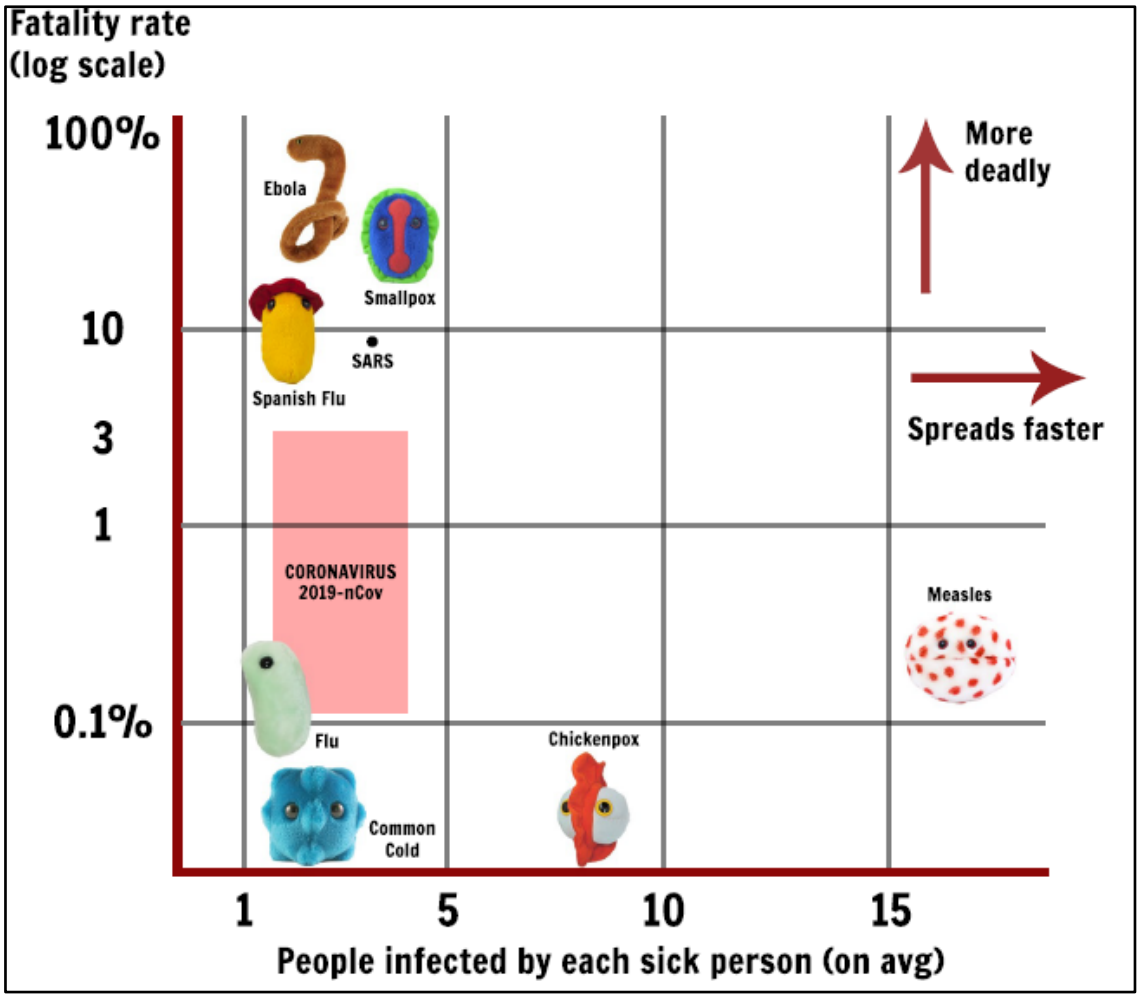


Fig. 4 Impact of Viruses in terms of Spread and Effect [9]

Pandemic effect in humans, by the viruses, are caused by a cycle that involves (i) infection among human, (ii) replication among human and (iii) rapid spread among the human and right now, it is very much unclear how easily the virus spreads from person to person. The human coronaviruses are supposedly spread from an infected person to others through (i) the air - respiratory droplets when a sick person coughs or sneezes, (ii) close personal contact (touching or shaking hands), (iii) an object or surface with viral particles (subsequent human contacts through mouth, nose or eyes before washing your hands) and (iv) rarely from fecal contamination [7]. These viruse particles are pushed into the atmosphere and eventually affect air quality [10]. Poor ventilation, dirty air conditioner or HVAC system help speed up the spread of bacteria and viruses, in general [11, 12].

COVID-19 is said to spread in a country or a space, following a four different stage namely (i) stage 1 – the country is not the source of the pandemic, still reports first few cases of the disease due to virus import; stage 1 happens when the epicentre of virus outbreak unable to

contain the virus spread; (ii) stage 2 – happens when local transmission of the disease are reported, spreading through the people of a particular country itself but possible to identify the trajectory of the virus; (iii) stage 3 – happens when community transmission of the disease is observed and difficult to track the chain of transmission and stage 4 signifies the pandemic reaching the epidemic stage, affecting the masses and the measures to contain the virus and control the affected persons become very difficult.

Masks, Respirators And Ventilators:

Masks are often used by healthcare providers in hospitals and clinics, where the risk of transmitting or catching an illness is high. In healthcare set-up, primarily masks are used to isolate from patients as well as protect the patients from potentially spreading the infections. There are two types of masks used in preventing infections: surgical masks and respirator masks.

Surgical masks (also known as dusk mask, procedure mask, medical mask or simply face mask) are basically small pieces of cloth used to keep the germs from their coughs and sneezes to themselves, or to prevent picking up infections from others (Fig 5 (a)). Surgical masks provide a physical block to protect the mouth and surrounding areas and often used as an integral part of the system where multiple barriers are used including surgical gown, gloves, eye-protection systems [12, 13, 14]. Surgical masks potentially can protect against droplet-spread infections, like influenza and other common respiratory infections but not designed to protect the wearer from inhaling smaller airborne bacteria or virus particles, e.g. mycobacterium tuberculosis [12]. Since the medical face masks are designed to stop water droplets, they are fit loosely, and may leave a gap between the edges of the cover and skin, making the masks less effective at protecting against smaller particulates that sneak around the edges. Heavier drops of water are less likely to skirt around the edges of the masks, and if a mask gets soiled, it can make things worse instead of better.

Due to shortage of surgical masks and respirators in the present COVID-19 situation, a new type of protective mask, “barrier mask” (Fig. 5 (b)), has come into the use, as Do-It-Yourself practice, to be worn by healthy people, healthcare professionals and others who are at the risk of exposure.

Fig. 5 (a) Surgical Mask, (b) Barrier Masks

Face masks and respirators, both, are capable of providing protection against airborne particles though they are different in their design and function [13, 14].Respirators are similar to face masks in shape and often indistinguishable but much more capable of safeguarding against tiny airborne particulate pollutants including pathogens.A respirator usually takes the form of a partial or full face-mask that is secured in place with a strap to filter the airborne microbes, viruses. In certain cases respirator masks are reusable also [14, 15].

Two of the most common respirator masks are N-95 masks and N-99 masks, which, when used correctly, prevent 95 % and 99 %, respectively of airborne particles from entering mouth or nose of the wearer [13]. N-95 and N-99 respirator masks can protect against airborne illnesses like measles, chickenpox, or tuberculosis and situations when the mode or pattern of disease spread is uncertain and ensure high level of protection. However, continuous use of respirator, which is essential to remain protected, leads to discomfort to the wearer and may lead to physiological impacts [9, 14]. Structure of a respirator is precisely engineered so that the mask (respirator) fits tightly against the face, reducing the gap. While industrial-grade respirators leave practically no gap with face, the wildfire smoke masks - often designed to reduce pollution down to tolerable levels instead of eliminating - save lungs from the strain of a sealed respirator. The filtering material in the respirators is denser enough to safeguard against PM2.5 (particles or droplets in the air that are 2.5 microns or less in size) particulate pollutants caused by vehicular exhausts, smokes and industrial emissions.

Though masks and ventilators are functionally different, often, they are used interchangeably, since both are used as breathing aids [15]. A respirator is a mask-like device that filters fine particles from inhaled air, whereas the ventilator is a machine that assists or performs the breathing process, whoever needs critical care but does not facilitate the breathing function

(Fig. 6). On the other hand, ventilator is a device that aids or performs the breathing process in the case of patients whose respiratory function is impaired for various reasons including COVID-19. Ventilator is a complex assisting system that uses compression system to force air (oxygen) into the lungs of a patient with reversing action taken care by automatic contraction of lungs.

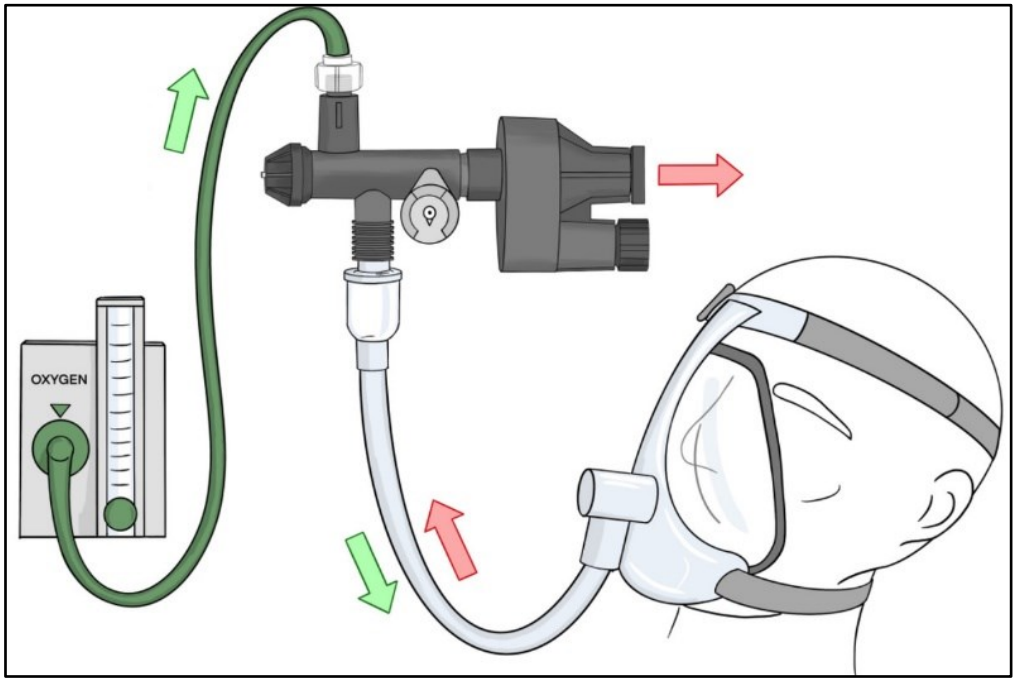


Fig. 6 Schematic Representation of a Ventilator

[Ref: https://chicago.suntimes.com/coronavirus/2020/3/31/21201997/]

Design Features And Testing Of Masks And Respirators:

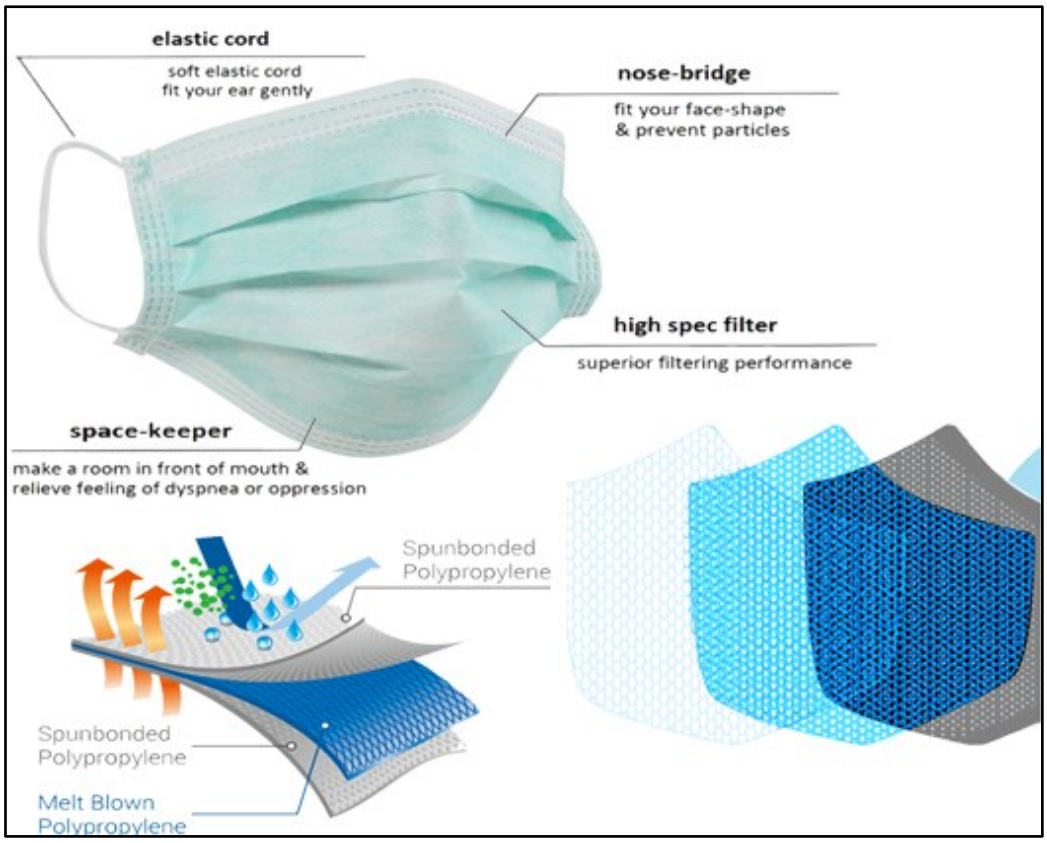
Surgical masks are made of a nonwoven fabrics created using a melt blowing process. They came into use during the 1960s and largely replaced cloth facemasks [9, 12]. While the facemask are effective in blocking splashes and large-particle droplets, by design, do not filter or block very small or tiny particles in the air, transmitted through coughs / sneeze. For those with chronic illness, wearing a face mask can be especially important for stopping dust mites, mould spores, and pollens, while exposure to pathogens cannot be ruled out if the mask is not properly fitted to seal around the face [17, 18, 19].

Thin surgical masks, meant for healthcare professionals, don't offer much in the way of protection but intended to stay away from pathogens that might spread during medical procedures.The fact that these masks fit loosely around the face makes it easier for the entry

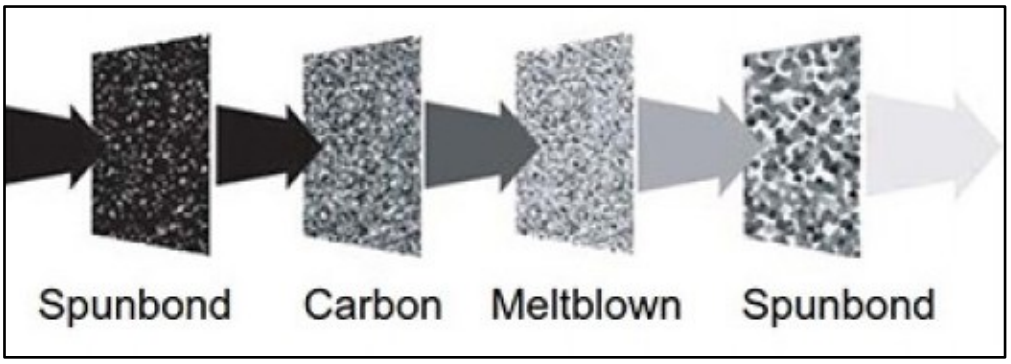
of foreign particulate materials. These masks are single-use devices and should not be worn for more than 3 to 8 hours.

Surgical masks, once made simply with a strip of cloth, are today manufactured using multiple layers (Fig. 7) (two / three / four layers) of thin non-woven fabrics (20 or 25 g/m2) of finer polypropylene fibres with or without filter layer(s) [12, 14]. These surgical masks are available in different styles and grades based on the level of protection expected. Masks are made of polystyrene, polycarbonate, polyethylene, or polyester fibres [20]. The filtration levels of a mask depends on the fibre, method of manufacturing, web structure, and cross-sectional shape of the fibres used.

A 3-ply surgical mask (Fig. 7) has three layers namely, (i) an outer hydrophobic layer, which repels water, blood and body fluids, while wicking inner moisture to evaporate efficiently, (ii) a middle filter layer that is designed to filter bacteria with one or two layers (without affecting breathability and comfort), and (iii) an inner hydrophilic layer, which absorbs water, sweat and spit, where jersey and interlock structures are also suggested [9, 12, 20]. In a 2-ply face mask, both layers are usually made up of polypropylene nonwoven without filter layer [12]. Masks are made by ultrasonically welding the layers together, and stamping the masks with nose strips, ear loops, or knitted / braided / folded-over elastic that go around the head to secure safely [9, 20] to satisfy certain characteristics and functional requirements (Table 1).



(a)



(b)

Fig. 7 (a) Three-Ply and (b) Four-Ply Masks

Quality and performance measures of the masks are recommended by different agencies including Government (FDA, NIOSH, and OSHA) - regarding protection requirements for end users, standardization organizations (ISO and NFPA) for performance requirements and test method providers (ASTM, AATCC) with respect to standardized methods to test and ensure product safety [20, 21]. There are four levels of ASTM certification that surgical

masks are classified in (Table 2), depending on the level of protection they provide to the person wearing them [21].

Table 2 Classification of Surgical Masks – Protection, Property and Uses

Protection Level	Properties and Uses
Minimum Protection	Face masks meant for short procedures or exams without inolving fluid, spray, or aerosol
Level 1	Face masks used for surgical and procedural applications, with a fluid resistance of 80 mmHg
Level 2	Masks with 120 mmHg fluid resistance, provide a barrier against light or moderate aerosol, fluid, and spray.
Level 3	Face masks for heavy possible exposure to aerosol, fluid and spray, with 160 mmHg fluid resistance.

These disposable masks are sterilized at the last stage of manufacturing process. Once surgical masks are made, they must be tested to ensure their safety in various situations. There are five different tests (Table 3) carried out for surgical masks.

Table 3 Suggested Test Methods for Masks

Test Parameter	Method	Need
Bacteria Filtration Efficiency	Tested with an aerosol of *Staphylococcus aureus* at a specified rate (EN, ASTM)	Ensures protection against the infiltration of pathogens
Particle Filtration Efficiency (latex particle challenge)	Spraying an aerosol of polystyrene microspheres	Ensure protection against required size of particles
Breathing Resistance	Measuring air-flow resistance at a given pressure level on both sides of mask	Ensures proper ventilation while the wearer breathes
Splash resistance	Splashed with simulated blood at forces closer to human blood pressure	Ensure protection against splash of liquids to avoid contamination
Flammability	Measures the extent of burning tendency (time and extent)	Ensure Protection from fire accidents in an operating room

Respirators:

A respirator prevents a wearer from inhaling droplets, aerosols, vapours or gases / disinfectants that pose greater health hazards [19, 22, 23]. Respirators of different classes

certified by EU Standards (FFP) or US Standards (N Type) offer high filtration against particles and aerosols. There are two basic types of respirators namely (i) air filtering and (ii) air-supplying (or insulating). Air filtering respirators (such as an N95 respirator) consist of a facepiece and a filtering device, stop contaminants, bacteria from reaching the nose and mouth while air supplying respirators (PAPR) supply the user with clean air from a tank or other uncontaminated sources [9]. Depending on the type of filter, the mask will either be effective only against particles, only against certain gases and vapours, or against particles, gases and vapours. Filtering respirators are sometimes also equipped with an exhalation valve to improve user comfort.

N-Type Respirators:

N95 respirators are one of the products in demand while treating COVID-19 infected patients. N95 respirators are originally developed for industrial applications, which are specialized masks (Fig. 8) that has the capability to filter out at least 95% of particles of the size above 0.3□, if properly fitted (i.e. efficiency depends on proper fit of the respirator, understood in terms of leakage) [17]. N95s respirators (or N95 alpha masks), featuring with exhalation valve suitable for hot or humid environments, are single-use products regulated as class II products under FDA and NIOSH, help the wearer to breathe easily and are also known as the "Bird Flu" mask or "Swine Flu" masks [18]. There are also N99 and N100 respirators (N100s stop at least 99.97% of particles from entering) that are virtually leak-proof.

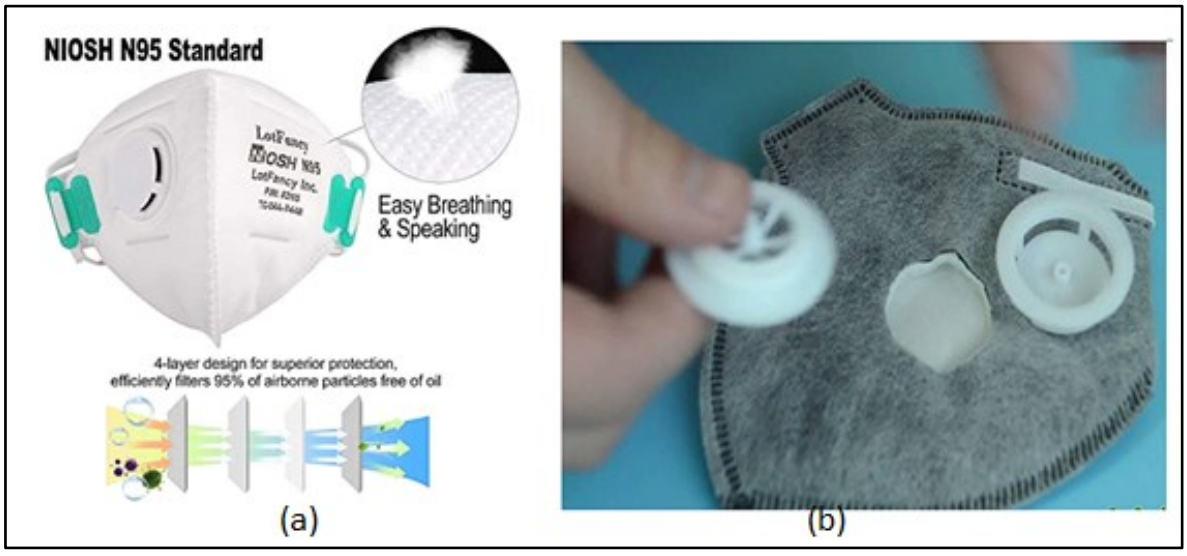


Fig. 8 N-Type Respirators (a) N95 and (b) N95s

A medical N95 respirator consists of multiple layers of nonwoven fabrics, often made from polypropylene. The two outward protective layers of fabrics, having areal densities 20 and 50 g/m2 covering the inside and outside of the mask, are made-up of spun-bonded thermoplastic polymer nonwoven materials, protect against the outside environments act as a barrier to in the exhalation process. Between these spun-bond layers, a high-cohesive needle-punched nonwoven (250 g/m2) is used as the pre-filtration layer. Further, hot calendaring or thermal bonding makes this layer thicker and stiffer enough to be moulded into different shapes. The last filter layer that consists of a high efficiency melt-blown electret (or polarized) nonwoven material, often made-up of sub-micron fibres, decides the filtration efficiency. Sometimes, this layer is thermally bonded to enhance the strength and abrasion resistance values.These layers are combined together with ultrasonic welding with necessary straps and strips, then sterilized as the last step. N95 respirators work by filtering out the particles owing to the tortuous network structure of nonwoven materials used in the assembly, aided by electrostatically charged layer to further attract particles. As particles build up, filtration efficiency of the mask becomes higher and breathing becomes difficult.

N95 respirators are subjected to several tests to ensure their effectiveness, tested after conditioning for 24 hours (38o C, 85% RH). N95 respirators are tested for (i) particle penetration – using charge neutralized sodium chloride aerosol spray (with median particle size of 0.3 micron), (ii) air flow (85 LPM) for moderately high work rates, (iii) breathing resistance – measured at 35 mm or below water column height pressure, and exhalation resistance - at 25 mm or below water column height pressure, (iv) aerosol loading - at least 200 mg, to simulate a high level of exposure and assess clogging tendency. Respirators are also tested for flammability, biocompatibility, fluid resistance, and particulate and bacteria filtration as per the standards of the Food and Drug Administration. With respect to particulate protection, respirators are classified into three categories by EU standard (EN 149:2001) as FFP1, FFP2 and FFP3 and NIOSH Standards – Class N (No oil resistance and specified particulate filtration efficiency), Class R (Oil resistance up to 8 hours with particulate filtration efficiency specified as R95, R99, R100) and Class P (Completely oil-resistant, P95, P99, P100).

FFP Respirators:

Filtering Facepiece Particles Mask, also known as FFP mask, is a half-face mask designed to cover chin, nose and mouth, available in three different grades (Table 4). This EU certified

mechanical-filter respiratory protection mask is capable of giving protection against particulate pollutants, infectious agents (including viruses) in the form of aerosols, droplets or solid particles [24, 25]. The masks can also be equipped with an exhalation valve to enhance the comfort, prevent condensing and settling of moisture in the masks from the exhaled air. Protection levels of FFP respirators are approximately 11 to 16 times higher than surgical masks. Different performance values are also reported for FFP masks in the literature for modified versions. However, the addition of a valve carries the risk of malfunctioning, the risk of infiltration of the virus or toxic dust.

Table 4. Classification of Filtering Facepiece Particle Masks

Type of Filter	**FFP1**	**FFP2**	**FFP3**
Extent of Protection	Least	Medium	Highest
Aerosol Filtration (%) up to 0.6 micron	80	94	99 to 99.95
Internal Leakage (%)	22	8	2
Applications	Dust Mask	Particulates, powders, influenza viruses, bacteria	Fine particles
Ease of Identification	Attached with Yellow elastic band	Attached with Blue elastic band	Attached with Red elastic band

Powered Air Purifying Respirator:

Powered air purifying respirator (PAPR), a personal protective equipment, is often recommended for individuals working in a polluted environment including dust, fumes, smoke, harmful gases or chemical vapours (Fig. 9). It is a power operated equipment that has a fan to provide clean breathable air through the filters (positive airflow through a filter, cartridge, or canister) and supply hoses connected to half or full-face masks or mouth pieces (to a hood or face piece) [26, 27].

PAPR types (types of filter, cartridge or canister) vary depending on the requirement / pollutants present in the environment, differentiated by the colour codes of filters / canisters meant to provide protection from nanomaterials such as dusts, paint mists, etc. Particulate Power Air Purifying Respirators (PPAPR) are used to filter dust, fumes and mists while Combination Respirators are capable of addressing both particulates and gases / vapours. PARPs may be belt mounted, helmet mounted, face mounted or vehicle mounted. The National Institute for Occupational Safety and Health provided guidelines for different

respirator models to ensure the expected levels of performance standards. The correct sequence of donning, doffing and hand hygiene is important to ensure the effectiveness of the PAPR and the N95 masks [27].

Fig. 9 Powered Air Purifying Respirator

Conclusion:

SARS virus, a type of coronavirus that has a size of 100 nm can easily pass through such barriers, like influenza virus (80 to 120 nm). Though the size of the new COVID-19 virus is currently unknown, human coronaviruses are generally about 125 nm well below the cut-off values available for mechanical respirators. However, viruses often travel on top of larger carrier molecules—like globs of mucus—making it easier to filter them. That is the reason the many agencies / administrators recommend to cover the face with home-made masks. In addition, using a surgical mask helps preventing from touching the face since many people do not get infected by breathing the viral particles floating in the air, but by touching mouth and nose with their contaminated hands. Use of high-efficiency particulate air filters in PAPRs provides greater respiratory protection than N95 masks with additional protection to heck and head. Recently developed gas masks protection from chemical, biological, radiological and nuclear threats (CBRN), while MIRA Safety ParticleMax P3 Filter assures protection from pandemics including Ebola, coronaviruses and H1N1. Judicious selection of filter materials coupled with the certain degree of comfort to the wearer would be, essentially, the choice of

many who suffer due to the diseases caused by the viruses and who are involved in providing treatments to the patients.

Acknowledgement:

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5. Perceived Discrimination In North East India: Epiphanies Versus Ironies

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Abstract:

The present study examined the perceived discrimination experienced by individuals of different age groups across different regions of North-East India. The study explored the differences in the sub-dimensions of perceived discrimination, namely lifetime discrimination and daily discrimination on the grounds of religion and gender. Data was collected from 241 individuals ranging from 20 to 60 years of age hailing from different parts of North-East India (47.3% males and 52.7% females). The Perceived Discrimination scale developed by Williams, YU, Jackson and Anderson (1997) was used in the current study. Results revealed that in the multivariate analysis of test (MANOVA) carried out there was no significant difference between males and females when considered jointly on the two dependent variables. A separate ANOVA was conducted for each dependent variable also revealed that there was no significant difference between males and females, both on lifetime discrimination and daily discrimination. The MANOVA results on the ground of religion revealed that there was a significant difference between Hindus, Muslims and Christians when considered jointly on the two independent variables.

Keywords:

Perceived discrimination • lifetime discrimination • daily discrimination • North -East India

Introduction:

The abstract significance and outcomes of perceived discrimination rely upon the situation of one's gathering in the social structure. Discrimination can be termed as a behaviour, which is unjust and the attitude of which is based biased treatment to an individual, a specific gathering or certain gatherings on the grounds of ethnicity, race, language and sex and so forth. Discrimination is a significant part of shame (Link and Phelan, 2001), and where social imbalances exist, it is a key component of intergroup connections and serves to fortify the

emblematic limits that different social gatherings from one other (Jackman, 1994). Discrimination based on race has received broad research consideration, and there is proceeding with logical enthusiasm for the inescapability and determination of racial segregation for racially criticized groups. Sex, racial, religion, and different types of discrimination are by and large seen as social ills, barring people from circumstances accessible to others dependent on attributes, for example, an individual's sex or skin colour. Discrimination often is not directly observable but shows itself just in a roundabout way, as ex-post disparity across gatherings of the populace. Be that as it may, a similar disparity can likewise emerge if bunches contrast in pertinent monetary qualities or if their individuals settle on deliberately various decisions. Hence, if the presence or absence of discrimination cannot be watched legitimately, the inquiry becomes whether inconsistent results establish proof of inconsistent treatment or not.

2. Discrimination And Its Consequences:

The existence and the experience of discrimination in whichever form it breeds is indeed a complex phenomenon and its existence is multidimensional and is an unavoidable wonder in the lives of numerous racial minorities. It can appear as both explicit and subtle behaviours that saturate the day-by-day lives of people (Sellers & Shelton, 2003). Perceived discrimination, for instance, may not just directly affect mental prosperity, but also have roundabout impacts through a bringing down of sentiments of control. As such, feeling of control may fill in as an interior instrument by which the experience of discrimination shows its psychological consequences. It is important to note here that the experience of discrimination to a great extent will be dependent whether one is a member of a relatively advantaged or disadvantaged group. There have been several studies and researches, which have shown a direct positive correlation between perceived discrimination and lower self-esteem. Numerous survey studies have supported this idea by consistently showing that perceived discrimination is associated with lower self-esteem and less positive self-feelings. But it is interesting to note that there could be certain benefits as well associated with perceiving discrimination as at times it may provide an external attribution or attributing the causes of certain negative personal outcomes or behaviours to external factors rather than owning it for themselves. If we go by the definition of discrimination, it indicates that it is an unjust treatment towards people on the basis of their association with certain groups the membership of which is often beyond their control, which indicates that the cause of this

discrimination revolves more around the perpetrators rather than the victims. In this sense, there is a possibility of individuals being able to safeguard their self-esteem by considering external factors to be responsible for their failures or shortcomings, rather their own personal negligence or mistakes. This gives an idea of the concept of Locus of Control, which indicates how strongly people believe they have control over the situations and experiences that affect their lives. This concept was developed by psychologist Julian Rotter, who devised the Internal-External Locus of Control Scale (I-E) to assess this dimension of personality. Therefore it can be believed in a way that individuals who often have a complaint against others being biased towards them and they being discriminated on several grounds, may probably have a tendency to blame external factors for anything wrong that occurs in their life. But, of course this understanding cannot be generalized. This clearly does not indicate that people desire to be discriminated against, or that there is no real evidence of discriminations in their perceptions of discrimination. However, it asserts that perceptions of discrimination can furnish individuals with self-defensive clarifications that are here and there difficult to discredit. This limiting speculation has been criticized on that attributions to discrimination are rarely completely external, as they include individuals' social personalities, which are inward and frequently focal qualities of them.

3. North-East India And Discrimination:

There are eight states, which comprises the northeastern region of India namely; Meghalaya, Manipur, Mizoram, Arunachal Pradesh, Assam, Tripura, Sikkim and Nagaland. There have been several instances reported from time to time which has shown that Northeast India has remained isolated from the main stream Indian culture. It is said that India is a 'Place where there is Unity in Diversity' and it tends to be well found in the North-Eastern area, which comprises of almost about 225 tribes living respectively and advancing their exceptional culture and custom. Yet, when this expression is appropriately investigated, we can discover a feeling of dissimilarity, which frequently the 'alleged standard India' rehearses. It can be said so because of the reports of the prevailing instances of discriminations and prejudices directed towards the people of North East India for varied reasons in varied instances. Some of the common terms used frequently to mock the people of Northeast due to their facial features are 'Chinki', 'Chowmein', 'Chinese', 'Nepali', etc. Such kind of racist behaviour towards the people hailing from a particular specific region may be attributed to reasons such as relatively poor knowledge and limited information and also misinterpretation of

information, which eventually leads to the development of such narrow mentality towards a specific group of people. The recent pandemic has created one notice that the humankind is not absolute however solely a vicinity of the nature. Times like these bring forth truth nature in the majority that ends up in a mass mentality. The folks of the northeast of India are suffering in a silent manner for quite sometimes, which can be credited to the multiple prejudices against them and their culture and practices. Episodes of individuals from the Northeast India being racially criticized in uber urban areas, for example, Delhi, Bengaluru and Kolkata started becoming exposed over the previous month. From being inquired as to whether North-East individuals eat creepy crawlies, live in timberlands, or heft weapons around; to being called 'Coronavirus' during the Covid-19 pandemic and tossed out of houses for looking 'Chinese', this area has confronted an exceptionally novel sort of discrimination which scarcely includes in broad daylight discusses. As of late notwithstanding, the Covid-19 panic is bringing out undeniably progressively vile sides to the terrain populace of India. Cases go from being called names to being spat on an open street, all in light of the manner in which they look. In the days after the Delhi mosque group was accounted for by the Indian media, a progression of Islamophobic hashtags picked up footing via web-based networking media, Bits of gossip, misinformation and recordings guaranteeing Muslims were intentionally spreading Covid-19 were generally shared, fanning effectively aroused strict pressures in the nation, and North East India was no exemption. Disconnected, Muslims across India with no association with the social occasion in New Delhi state they were focused as India's reaction to the infection increase. Thus, the present study is part of this perspective and focuses on the evaluation of perceived discrimination of the people of North East India on several grounds, and since moreover the present survey has been carried out during the period of COVID-19 outbreak, a number of situations associated with the lockdown period, have also been highlighted and taken into consideration.

4. The Current Study:

The purpose of this current study was to examine the level of perceived discrimination experienced by individuals of different age groups across different regions of North East India. The sample consisted of individuals hailing from different parts of North East India, namely, Assam, Manipur, Siliguri, Nagaland, Meghalaya and Gangtok. The study aimed to determine the levels of perceived discrimination on two of its subscales, that is, lifetime discrimination and daily discrimination, to identify the patterns of discrimination experienced

by the people of various age groups of North East India on a daily basis as well as their perception of discrimination during their lifetime. The study was undertaken during the COVID-19 global pandemic lockdown period and was particularly conducted in view of the several instances of discrimination and racist remarks towards the people of North East in different parts of India during the COVID-19 global pandemic situation. Also religion and gender has been taken as strong variables in the current study as it has been seen reported in various platforms about instances of domestic violence and also the rising rate of Islamophobia during the period of COVID-19 lockdown. The gathering held by the Tablighi Jamaat of the muslim community in Delhi's Nizamuddin area is believed to release a number of Covid-19 clusters across the country. The Jamaat is said to send out its representatives to different countries for a period of 40 days or lesser and the preachers believe in one-to one contact for the same. An annual event of the Jamaat was held in New Delhi which was attended by Muslims from India and abroad. It is believed that among the attendees of the Jamaat there were a few of them who were carrying the Covid-19 infection that is now being carried and infected several other people in different parts of the country. After this incident hashtags such as #CoronaJihad, #NizamuddinIdiots, began trending, as reported in BBC News (3rd April 2020). As per a report of the News18 INDIA (April 5, 2020) which is an Indian Media television channel owned by Network 18, several truck drivers belonging to the Muslim community were brutally beaten up in Arunachal Pradesh of North East India. As reported in THE FEDERAL (8 April, 2020) which is a digital platform disseminating news, analysis and commentary, it was found that in Assam there were several unofficial notices being made popular in several social media platforms which imposed restrictions on muslims in entering certain areas. Taking into consideration the prevailing circumstances of the global pandemic, there have been a number of cases reported which showcase instances of gender inequality, gender discrimination and domestic violence in different parts of the world. It has been found that due to the social distancing that has prevailed due to the COVID-19 outbreak, there has been a huge detrimental impact on the employment front of women as compared to the male counterparts (Alon, Doepke, Rumsey & Tertilt, 2020). As per a new UN report of the impact of the COVID-19 on women and girls (2020), it has been seen that the current lockdown can result in a higher rate of domestic violence against females as they are spending more and more time with their male partners in a common household. It was reported that incidence of violence against women and girls specifically domestic violence have accelerated during the COVID-19 outbreak as there has been emerging worries due to several insecurities in areas of health and financial sectors accentuated by the confined living

conditions during the quarantine period. As reported in The Diplomat (April 17, 2020) which is an international magazine covering current affairs for the Asia-Pacific region, that females who compose almost half of the country's total population, were not present in the COVID-19 policy of the Government, and there had to be a reminder to be given to the Government about certain hygiene necessities of women such as sanitary napkins to be included in the list of essential items during the lockdown period. Therefore in the light of such prevailing circumstances during the global pandemic, the current study has been undertaken to delve deeper into the perceptions of the people of North East India towards discrimination, and whether there is any similarity between the globally reported cases of discrimination on gender and religious grounds with the actual findings of the current survey on the selected sample from individuals of North India.

5. Method:

The Sample consisted of 241 individuals ranging from 20 to 60 years of age hailing from different parts of North East India (47.3% males and 52.7% females).

The respondents were selected on the basis of convenience, their willingness and availability to participate in the survey being undertaken. They belonged to three different religions, that is, Hindu, Muslim and Christianity and were from different occupations such as private or government employees, students, homemakers, unemployed, businesspersons and so on. The study followed all the relevant research ethical guidelines and informed consent was obtained from the participants before they participated in the survey. The inclusion criteria for the present study was male and female participants who belonged originally from North East, but may or may not be currently residing in North East; in order to understand the perceived discrimination they have experienced not only within their place of origin but also their current place of residence or any other place they might have visited or travelled to. The scale that has been used in the current study assesses not only their lifetime perceived discrimination but also the perceived daily discrimination. Age was not considered to be determining criteria for selection of participants.

6. Measures:

The 20-item Perceived Discrimination Scale developed by Williams, Yu, Jackson, & Anderson (1997) was used in the current study to measure the Perceived discrimination of the

participants. This scale has two subscales: The Lifetime Discrimination Scale and the Daily Discrimination Scale. This scale measures the Perceived discrimination varied grounds, such as religion, race, gender, physical appearance, sexual orientation and so on. The Cronbach's coefficient for the Lifetime Discrimination Scale was found to be = 0.53 and for the Daily Discrimination Scale it was Cronbach's coefficient = 0.76.

7. Procedure:

Data was collected from the participants by preparing Google forms which was being circulated during the period of COVID-19 lockdown. Informed consent was being obtained from the participants and they were debriefed via email after completing the survey. First of all, the respondents had to respond to a socio demographic questionnaire on completion of which they were being directed to the Perceived Discrimination questionnaire which consisted of 20 items. The questionnaire consisted of two subscales: The Lifetime Discrimination scale which consisted of 11 items which gave a measure of the unfair treatment over the course of their lives. The other subscales were the 9-item Daily Discrimination scale which gave a picture of the participants' unfair treatment in their day-to-day lives.

8. Results:

Since Gender and religion were the Independent variables in the current study, the data that was collected comprised of 32.4% Hindus, 38.2% Muslims and 29.55 Christians. As mentioned earlier, the sample consisted of 47.3% males and 52.7% females. The Dependent Variables in the current study were Lifetime discrimination and Daily Discrimination.

A multivariate analysis of variance (MANOVA) was used to determine the difference between males and females on the two subscales of the Perceived Discrimination Scale. The Perceived Discrimination of the males and females was analyzed for statistical significance using Wilk's Lambda statistics. The results of the comparison are presented in Table 1.

Table 1: MANOVA-Differences In Perceived Discrimination Of Males And

Variable	Value	F	df	P	Partial η^2
Perceived discrimination	.983	2.01	2	0.136	0.017

In the multivariate analysis of variance (MANOVA) it can be seen that there was no significant difference between males and females when considered jointly on the two Dependent Variables taking Wilk's $\Lambda = 0.983$, $F(2,238) = 2.10$, $p = 0.136$ and partial $\eta 2 = 0.17$. Thus, we accept the null hypothesis, which indicates that males and females do not differ significantly when considered jointly on the lifetime discrimination and daily discrimination.

To further check the assumption of equal variances, the Levene's Test of Equality of Error Variances was carried out and can be seen in Table 2.

Table 2: Lavene's Test of Equality of Error Variances of Perceived Discrimination of males and females

Variable	F	df1	df2	Sig.
Lifetime discrimination	0 .077	1	239	0.781
Daily discrimination	0.668	1	239	0.414

After carrying out the Lavene's Test of Equality of error variances it was found that the p value of lifetime discrimination is found to 0.781 and p value of daily discrimination is 0.414, which are both higher than 0.05, therefore it provides some evidence that the Equal variance assumption is satisfied on the univariate level.

A separate ANOVA was conducted for each of the Dependent variables which can be seen in Table 3.

Table 3: ANOVA - Differences Between Lifetime Discrimination And Daily Discrimination Of The Male And Females

Variable	Sum of squares	F	df	P	Partial η^2
Lifetime discrimination	94.183	3.826	1	0.052	.016
Daily discrimination	78.415	0.258	1	0.612	.001

The significant differences in lifetime discrimination and daily discrimination were therefore analyzed separately for males and females by using ANOVA. Results of the ANOVA analysis showed that there was no significant difference between the males and females on the lifetime discrimination where, $F(1,239) = 3.826$, $p = .052$, partial $\eta 2 = 0.016$, where the

Mean of the males is 7.386 and that of females is 6.134. Similarly in the context of Daily discrimination, there was no significant difference between the males and females where, F(1,239)=0.258, p= 0.612, partial η2 = .001, where the Mean of the males is 22.377 and that of females is 23.520.

Religion was the second Dependent variable in the current study, and the respondents of the current study were individuals from three different religions. A multivariate analysis of variance (MANOVA) was used to determine the difference between Hindus, Muslims and Christians on the two subscales of the Perceived Discrimination Scale. The Perceived Discrimination of the Hindus, Muslims and Christians was analyzed for statistical significance using Wilk's Lambda statistics. The results of the comparison are presented in Table 4.

Table 4: MANOVA - differences in Perceived Discrimination of males and females

Variable	Value	F	df	P	Partial η^2
Perceived discrimination	.461	56.02	4	.000*	0.321

Statistically significant difference: p ≤ 0.05

In the multivariate analysis of variance (MANOVA), it can be seen that there was no significant difference between Hindus, Muslims and Christians when considered jointly on the two Dependent Variables taking Wilk's Λ = 0.461, F(4,474) = 56.02, p= 0.000 and partial η2 = 0.321. Thus the null hypothesis is not accepted in this case, which indicates that Hindus, Muslims and Christians differ significantly when considered jointly on the lifetime discrimination and daily discrimination.

To further check the assumption of equal variances, the Levene's Test of Equality of Error Variances was carried out and can be seen in Table 5.

Table 5 Lavene's Test of Equality of Error Variances of Perceived Discrimination for Religion

Variable	F	df1	df2	Sig.
Lifetime discrimination	.417	2	238	0.660
Daily discrimination	.713	2	238	0.491

After carrying out the Lavene's Test of Equality of error variances it was found that the p value of lifetime discrimination is found to 0.660 and p value of daily discrimination is 0.491, which are both higher than 0.05, therefore it provides some evidence that the Equal variance assumption is satisfied on the univariate level.

A separate ANOVA was conducted for each of the Dependent variables, which can be seen in Table 6.

Table 6: ANOVA - Differences between Lifetime discrimination and Daily discrimination for Religion

Variable	Sum of squares	F	df	P	Partial η^2
Lifetime discrimination	3211.137	138.112	2	.000*	0.537
Daily discrimination	95.347	0.156	2	0.856	0.001

Statistically significant difference: $p \leq 0.05$

The significant differences in lifetime discrimination and daily discrimination were therefore analyzed separately for Hindus, Muslims and Christians by using ANOVA. Results of the ANOVA analysis showed that there was a significant difference between Hindus, Muslims and Christians on lifetime discrimination where, F(2,238) = 138.112, p = 0.000, partial η2 = 0.537, where the Mean of the Hindus is 3.987, Muslims is 11.370 and that of Christians is 3.718. This indicates that in the dimension of Lifetime Discrimination the Muslim participants reported of being discriminated the highest as compared to Hindus and Christians

On the other hand in the sub-scale of Daily discrimination, there was no significant difference between Hindus, Muslims and Christians where, F(2,238) = 0.156, p = 0.856, partial η2 = 0.001, where the Mean of the Hindus is 23.487, Muslims is 23.293 and that of Christians is 22.014.

9. Discussion:

The purpose of this study was to examine the perceived discrimination experienced by the individuals of different age groups on the two sub-scales of the Perceived Discrimination Scale, namely, Lifetime discrimination and Daily discrimination. Two variables were taken into considering in assessing the level of perceived discrimination, that is, gender and

religion. In the dimension of gender it was found that there were no significant differences between males and females on both the subscales of Perceived Discrimination, which indicates that both males and females experienced relatively high perceived discrimination, but there were no significant differences in their perception. Therefore both males and females reported almost similar level of discrimination they perceived in their lifetime or on daily basis. Inline with these findings are a few observations and findings reported in a study by Ira Das (2013), where it was reported on the basis of indepth analysis of secondary data collected from the Census reports of the government, National Sample Survey Organisation (NSSO), Registrar General of India etc. , that the status of women in the various states of North East India are better to a certain extent in a few indicators as compared to the women in other parts of India. As reported by THE NORTH EAST NETWORK (2004), in a report for NATIONAL COMMISSION FOR WOMEN NEW DELHI, It has always been believed that females in North East India enjoy relatively greater freedom and mobility as compared t o women other parts of the country. This region has been found to be relatively free from certain practices such as dowry and bride burning. This example is often used in many situations to indicate that domestic violence and gender inequality is not very prevalent in North East India ,but the as mentioned in this report and as per the data collected by the North East Network ,violence against women in North East India, more specifically domestic violence is increasing in this part of the country. The findings of the current study is in contrast with the findings of the study by Branscombe (1998) wherein it was reported that the women participants in the study expressed of having experienced several disadvantages such as lack of liberty, discrimination in the work place, fear of sexual abuse. On the other hand in that study the male participants reported of having faced much less severe situations of discrimination such as being the first one or expected to pay the bill for shopping or on dates etc. Taking into consideration the current situation of COVID-19 lockdown, these findings are in contrast with the illustrations of gender discrimination and oppression against women mentioned earlier. As per a study by Kaur and Garg (2008), this could be possible because of economic dependence on their male counterparts many a times. Also sometimes due to the age-old cultural norms and values, women continue to stay in abusive relationships and do not open up about the atrocities they are subjected to. Many a times women consider themselves as responsible even if they have been abused by their partners. Many a time they fear that there will be a shame of being a woman who have been separated or divorced, thereby leading to an unwillingness to express the discrimination they face, eventually leading them to internalize the blame of problems in their life. Lack of education and

information also may play a crucial role herein, where many people are misinformed and consider the oppression as part of the results of their past wrong actions.

In case of the second variable, that is religion, it was found that, there was a significant difference between the perception of Hindus, Muslims and Christians towards in the context of Lifetime Discrimination. It was found that Muslims reported a higher discrimination with a mean of 11.37 as compared to 3.98 and 3.71 among the Hindus and Christians. This indicates that the Muslims have reported to be perceived a much higher lifetime discrimination as compared to the other two religions. This is inline with the findings of the review paper by Rowena Robinso (2016), wherein it has been mentioned that across the world Muslims are subjected to discrimination of all sorts. The data about Indian Muslims in the paper was collated from the Rajinder Sachar Committee Report and also materials collected about discrimination, marginality and human security from various other sources including the 2001 Census reports. Three crucial dimensions of social exclusion faced by the Muslims in India have been found to be marginalization, backwardness and discrimination. In the context of social and physical infrastructure , particularly poor served were found to be the Muslims. In the present study, the sharp distinction in the Perceived Lifetime Discrimination could be attributed to the recent incident that took place in Delhi's Nizamuddin in the month of March 2020 wherein several people across the country were found to be tested positive for COVID-19 post attending the religious congregation at the Tablighi Jamaat's Markaz, as reported in NEWS18 India (April 5, 2020). Post that, incident memes relating to Islamophobia started getting circulated on various platforms. As reported in ThePrint (April 2, 2020), The actions of the Jamaat were indeed irresponsible, but the fact that religious discrimination is being shown to Muslims across the country irrespective of whether they have any connection with the Jamaat or not, is not justified. It was also reported that the stereotypes against the Indian Muslims is not only being showcased by social media but also has caused several incidents of mob lynching against the Muslims in the country. The current study was conducted during the COVID-19 lockdown, just a few days after the Tablighi Jamaat's Markaz incident. Therefore, it might be possible for the Muslims of having reported higher perceived discrimination due to the several news and hashtags related to Islamophobia, which have made them respond in such a manner. Also it cannot be generalized that individuals of other religions had stereotypical attitude towards the Muslims, post the incident in the North East. There were individuals across the globe who were well informed about the situation and did not target the entire Muslim community and did not indulge in hate messages. Therefore such

secular mentality is the need of the hour and this message is not only to be inculcate in the youth, but amongst individuals of all age groups (which is the case in the current study), so that the seed of communalism is not allowed to breed in the North Eastern society, and to foster in harmony.

10. Conclusion:

It can be concluded that, Discrimination in any form, whether on a daily basis or on the basis of a lifetime, is not healthy for the society and will not benefit anyone. Discrimination may breed from any source, whether it is prejudice towards a particular individual, group or community, stereotypes etc. It can be shaped by factors operating at various levels and most often, the specific underlying mechanisms are very difficult to observe. Therefore, attempts have to be made at the organizational, national and most importantly at individual level to eradicate this evil from the society. Individuals of all age groups have a crucial responsibility in this concern. There can be suggestions of inclusion of tolerance related aspects as mandatory courses in the school syllabi. Children should learn about sensitivity for other people and groups from a very early age. Multiculturalism is the need of the hour, and the responsibility to spread this message is vested in the shoulders of individuals of all age groups to make North East India a region wherein Discrimination vanishes and there is usher of greater peace and harmony.

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6. Surviving The World Through The Ultimate Panacea: Plants

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Introduction:

The novel coronavirus 2019 (COVID-19), the unexpected pandemic, has caused severe panic among people worldwide. The advent of COVID-19 has kept the whole world on their toes. Countries are maximizing their efforts to combat the virus and minimize infection. However, most of the countries are unprepared for a disease at this magnitude and may not be able to prevent transmission or treat the condition efficiently. But the potential problem will continue to persist until the development of an effective viral vaccine. According to the World Health Organization (WHO), COVID-19 is the infectious disease caused by the coronavirus SARS-CoV-2. This new virus and disease were unknown before the outbreak began in Wuhan in December 2019. COVID-19 is now a pandemic disease, with nearly eight million confirmed cases and 434,367 deaths (WHO, 16 June 2020). Medicinal plants are considered as rich resources of biofunctional compounds which can be used in drug development or synthetic drugs. Ayurveda and Siddha practices originated in India and are still widely used among the Indian population. By identifying certain phyto-compounds, it is possible to effectively characterize medicinal herbs that could help to alleviate the infection. Hence, by repurposing the Indian medicinal plants, more innovative treatment options can be penned down for their role in defeating this viral transmission. At a time of worldwide anxiety, it is imperative to find long term solutions to prevent the transmission of such pandemics. So, it's time for all the citizens to join hands together to fight against corona-virus by practicing self-hygiene and social distancing. These plants play a critical role in the development of human cultures around the whole world. There are many benefits of herbal medicine as they are easier to obtain than prescription medicine, stabilizes hormones and metabolism, natural healing, strengthens immune system, fewer side effects. Application of modern technologies and methodologies in herbal medicine research can have a significant impact on the scientific validity, quality improvement, and standardization of herbal medicines.

Over View Of The Disease:

Coronaviruses (CoV) (Family: Coronaviridae) are enveloped viruses containing non-segmented, positive-stranded genomic RNA (Li, 2016) (Fig-1). Coronaviruses are named for the crown-like spikes on their surface (Fig 2). There are four main sub-groupings of coronaviruses, known as alpha, beta, gamma, and delta. People around the world commonly get infected with human coronaviruses 229E, NL63, OC43, and HKU1. It is found in 2 strains, which is named L and S strains. The S type is older, but the L type was more common in early stages of the outbreak. Coronaviruses having an impact on human health in past. SARS-CO V (Severe Acute Respiratory Syndrome Coronavirus) emerged in 2003, with a mortality rate of 10 % and more than 8000 cases were reported. MERS-CoV (Middle East Respiratory Syndrome Coronavirus) emerged in 2012, with a mortality rate of 35% and more than 2500 cases were reported. SARS-CoV-2 (COVID-19) emerged in 2019 and now declared as Pandemic. This Novel coronavirus (nCoV-19) has caused more than 8 lacks of deaths during January to August 2020 (Table 1.)

These viruses are pleomorphic particles with sizes ranging from 80 to 120 nm in diameter (Neuman et al., 2011). Their entire replication cycle takes place in the cytoplasm. Research findings indicated that the CoV envelope is involved in critical aspects of the viral life cycle, and that CoVs lacking CoV envelope make promising vaccine candidates (Schoeman & Fielding, 2019). CoVs are able to cause a number of diseases, including bronchitis, gastroenteritis, hepatitis, systemic diseases, and even death in birds, humans, and other animals. Coronavirus could possibly infect animals as well as humans causing severe gastroenteritis and respiratory complications. Serologically, three identified strains of the virus have been reported to date. They are classified as per their genome sequence and the host range. Two strains HCoV-229E and HCoV-OC43 have been recognized in 1960 causing the well-controlled common cold symptoms. The third life-threating corona virus named SARS-CoV can lead to lethal pneumonia. SARS-CoV has been identified as the most lethal coronavirus till then as has been mentioned in an article published in February 2004 (van der Hoek et al., 2004). This novel strain of corona virus managed to spread over a wide geographic location within a very short period of time.

Table 1: Growth Of The Virus At World Level

Journey of SARS-CoV-2 Towards Pandemic
December 2019: Unusual cases of Pneumonia reported in Wuhan, China
December 31, 2019: Coronavirus cases reported to WHO office China
January 1,2020: Seafood and meat market in Wuhan recognized as origin of the coronavirus and was closed
January 7, 2020: Chinese scientist identified the virus as a novel strain of coronavirus
January 12, 2020: Scientist shared the first entire sequence of the novel virus and diagnostic kit was designed
January 13, 2020: Thailand reported the first case of virus outside China
January 20, 2020: First case reported in US.
Journey of SARS-CoV-2 Towards Pandemic
January 24, 2020: First 3 cases reported in Europe
January 30, 2020: First confirmed case in India
End of January 2020: Novel virus was named SARS-CoV-2
January 30, 2020: WHO reported the disease as Global Public Health Emergency
February 11, 2020: WHO named the disease caused by SARS-CoV-2 as COVID-19
March 11, 2020: WHO declared COVID-19, a global pandemic.
July 2020: Total number of cases crossed 10 million globally with a death toll of over 5 lacs
August 25, 2020: Total mortality in the world over 8 lacs.

Transmission Of Disease:

SARS-Cov-2 appears to need to bind to the ACE 2 receptor to enable it to infect host cells. ACE2 receptors are found in ciliated epithelial cells in the upper and lower airway and in type II pneumocytes in the alveoli in the lower airway (Fig-3). Type II pneumocytes produce lung-lubricating proteins important for lung function. Four proteins, (Envelope, Spike, Membrane, Nucleocapsid) the spike, 3CLpro, PLpro, and RdRp are essential for the virus.

Therefore, therapeutics targeting one of these proteins is currently being tested as a possible treatment for SARS-CoV-2.

The penetration of the SARS-CoV-2 genome into the host cells occurs as a result of the SARS-CoV-2 spike protein binding to host receptors (Sigrist et al., 2020). By using phylogenetic analysis and critical site of ACE2 structure, different animals such as cat, pigeon, and sheep were predicted to be important intermediate hosts for SARS-CoV-2. Hoffmann *et al.* (2020) demonstrated that the ACE2 receptor is used by SARS-CoV-2 to enter human cells. Moreover, they reported that the use of TMPRSS2 inhibitors may be a promising therapeutic approach against SARS-CoV-2. TMPRSS2 is a transmembrane serine protease that cleaves both ACE2 and the S protein. Recently, Ortega et al. (2020) used *in silico* approaches to understanding the relationship between changes in SARS-CoV-2 Spike protein and ACE2 receptor. They demonstrated superior affinity of SARS-CoV-2 spike protein towards human ACE2 as compared to that of the Bat-CoV spike and ACE2. This study supported the idea that the ACE2 receptor may be the key "bridge" used by SARS-CoV-2 to transmit among humans. Chen et al. (2020) confirmed that although SARS-CoV and SARS-CoV-2 RBD of spike glycoprotein had 72% of structural similarities, SARS-CoV-2 RBD exhibited higher interaction with ACE2. ACE2 inhibitors are thought to indirectly alter the RBD binding site and therefore block SARS-CoV-2 infection. Likewise, Wrapp et al. (2020) found that the SARS-CoV-2 spike exhibited a higher affinity to ACE2 than SARS-CoV. Adedeji et al. (2013) demonstrated that early blocking of SARS-CoV with ACE2 inhibitors was one of the mechanisms used by novel efficient anti-SARS drugs. It is also notable that hypertension and diabetes mellitus significantly enhanced the risk of COVID-19 infection, in spite of using ACE2 inhibitors (Guan et al., 2019). Commercially available antiviral drugs mostly target the four major groups of viruses: human immunodeficiency virus (HIV), herpes, hepatitis and influenza (Razonable, 2011). Earlier outbreak episodes of viral infections like SARS-CoV and MERS-CoV as well as hemorrhagic fever viruses like Ebola were treated with this category of drugs (De Clercq, 2007). The major drugs undergoing clinical trials that have the potential to treat this viral infection (Table 2.) are listed, but due to side effects or developing drug resistance, more research may be required in traditional medicine to utilize them in the treatment of COVID-19.

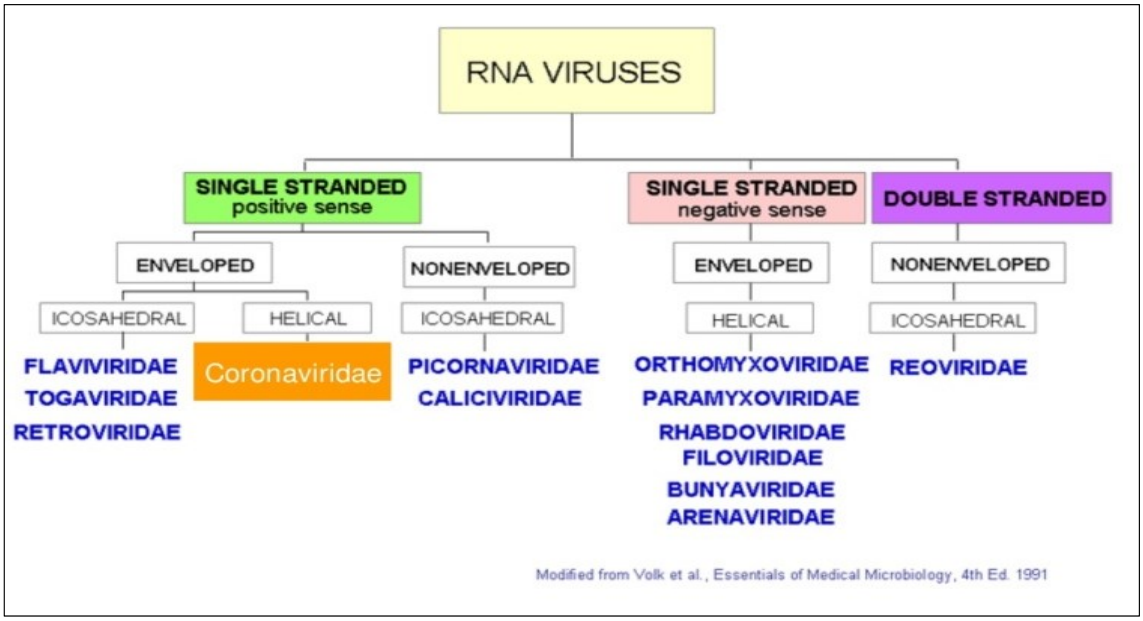


Fig-1 Classification of RNA Viruses

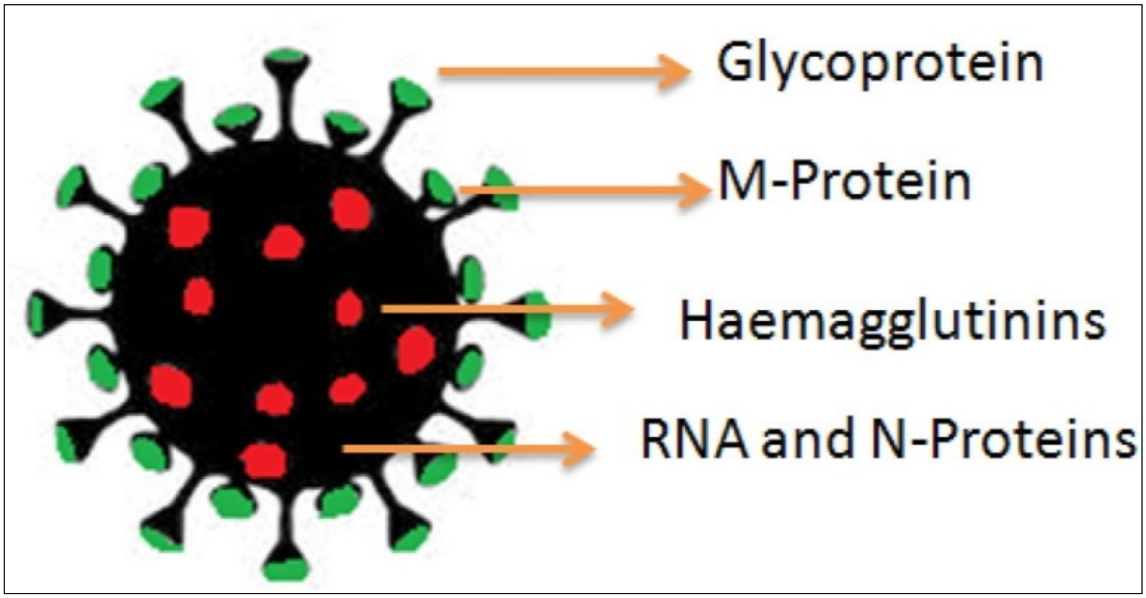


Fig-2 Model of Corona virus

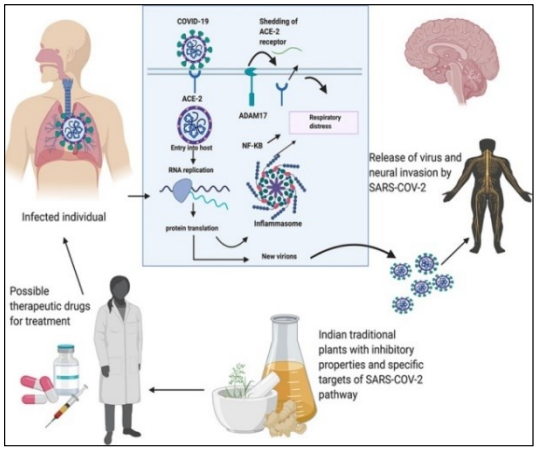
Natural Products A Cure For Control Of The Disease:

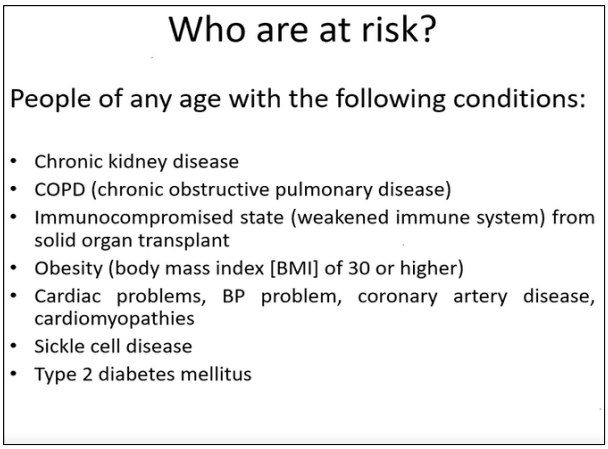
Natural products and their derivatives are used in folk medicine to treat numerous ailments including viral infections (Ganjhu et al., 2015). Nature provides a vast library of chemicals to explore and develop drugs for treatment of various ailments including viral diseases. To date, a good number of herbal medicines or their constituents have shown potential antiviral activity. However, there is a lack of adequate research on the development of anti-CoV

agents from such natural products. Such agents are not only important to combat CoV, but also play an important role to prevent viral attack.

To combat this deadly COVID-19, a number of conventional drugs like chloroquine, hydroxychloroquine, remdesivir, etc. have been tried and found with certain curative effect *in vitro*. However, the clinical drug response is not very encouraging and toxicity remains an inevitable issue causing serious adverse effects. This prompted us to study the inhibition of COVID-19 protease by Indian herbal plants. Because of the inherent side effects of the synthetic chemicals used in allopathic drugs, a sizeable population has switched over to the traditional system of medicine (herbal medicine) for their primary health care. Ayurveda, the age-old Indian system of medicine, is increasingly becoming a sought after system to bank on. The ayurvedic treatment has become an alternative to conventional medicines due to several reasons including easy availability, less or no side effects and less cost. India has always been a rich reservoir of medicinal plants because of several agro-climatic zones.

Fig-3. Natural Products as ACE2-Blockers.





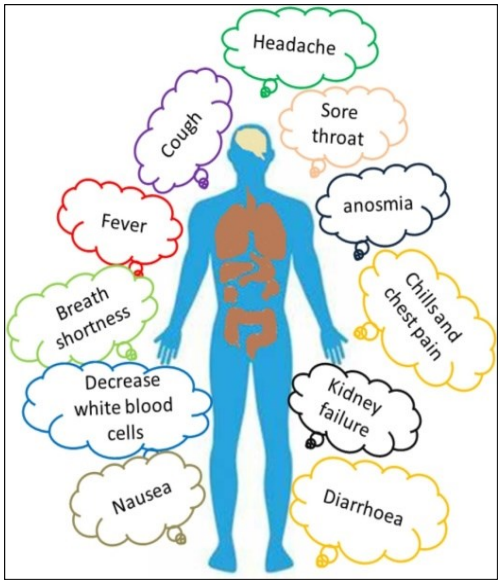


Fig 4- Symptoms of Covid-19.

Remdesivir	**Cortecosteroids**
Toxilizumab/Sarilumab	**Lopinavir/Ritonavir**
Nafamostat/Umifenovir	**Chloroquine/ hydroxychloroquine**
Ivermecetin	

Table 2- Drugs used in treatment of Covid-19

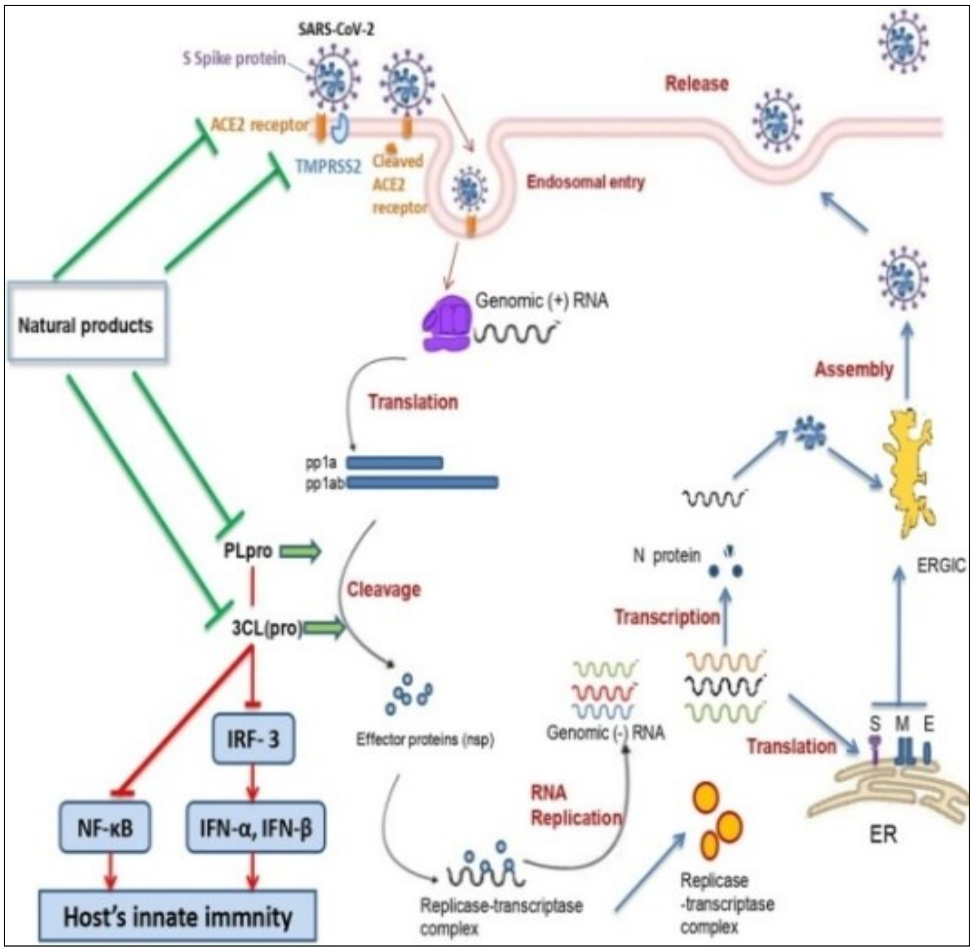


Fig- 5 Summary of Possible ant SARS-CoV 2

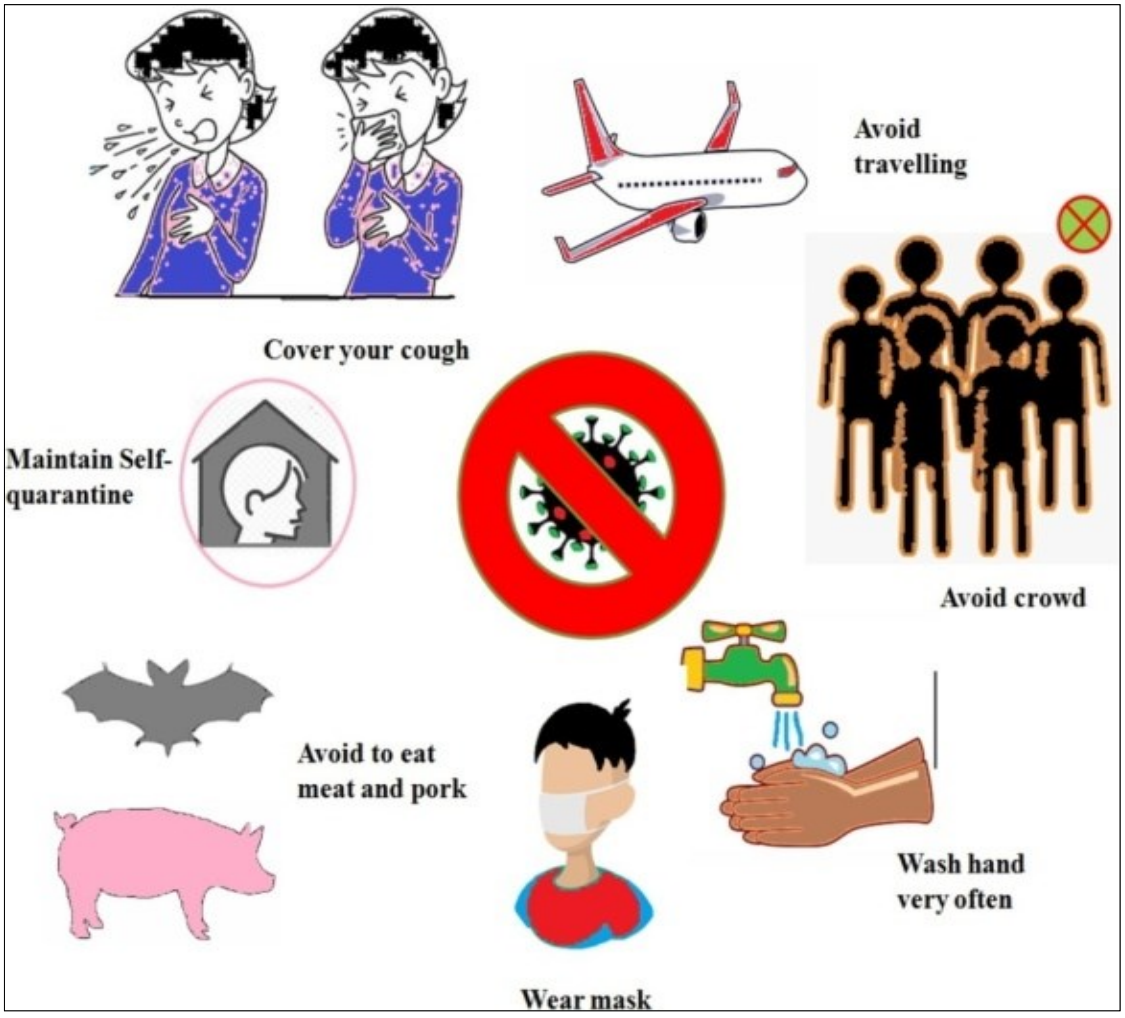


Fig-6 Precautions in Covid-era action of Natural products

India has varies species of medicinal plants that have secondary metabolites like steroids, saponins, flavonids, terpenes, phenols, alkaloids etc which have been found to possess anti-malarial, anti-viral or other similar activities. Traditional herbs from diverse geographical locations and various habitats are considered as potential sources of new drugs for treatment of viral infections, including those caused by SARS-CoV. Some natural products have been found to exhibit their antiviral activity through the inhibition of viral replication (Moghadamtousi, et.al, 2015; Oliveira et al., 2017). Other studies on coronavirus using medicinal plants are rather minimal in India, a study has shown anti-mouse coronaviral activity (a surrogate of SARS- CoV) by the plants. Some plants have been found to reduce inflammatory cytokines using the NF-kB pathway, a pathway that has been implicated in respiratory distress in SARS-CoV. *Allium sativum* (Keyaerts et al., 2007) have been known to target the viral replication of SARS-CoV, arising as promising candidates against SARS-CoV-2. *Adhatoda vasica* reduced infections caused by influenza viruses. The

molecular mechanism by which these plants target influenza virus can be studied to understand if they attack any molecules overlapping between SARS-CoV-2 and the Influenza viruses. Most importantly, various medicinal plants have shown inhibitory effects against ACE, those include *Cynara scolymus*, *Coscinium fenestratum*, *Punicagranatum Cassia occidentalis* and *Embeliaribes* (Hussain et al., 2018). The type II transmembrane serine-proteinase serine type 2 (TMPRSS2) cleaves the S spike proteins of SARS-CoV and MERS and ACE2 (Iwata-Yoshikawa et al., 2019). Since SARS-CoV-2 viral entry is conditioned by its binding to the ACE2 receptor, and the latter should be cleaved by the TMPRSS, finding agents able to suppress or down regulate the TMPRSS2 expression in human cells could represent a promising therapeutic or preventive approach. Several studies have demonstrated that natural products could down regulate or suppress TMPRSS2. Meyer and Jaspers, (2015); Mamouni et al., (2018) found that a standardized flavonoids formulation including luteolin, quercetin, and kaempferol significantly suppressed TMPRSS2 expression. 3CL(pro) belongs to the 16 nonstructural proteins of the SARS-CoV-2. Since it plays an important role in the SARS-CoV-2 replication process polyproteins, 3CL(pro) is considered a potential therapeutic target for anti-COVID-19 drugs (Zhang L. et al., 2020) Hence, medicinal plants-derived products or natural products able to selectively block the ACE2 receptor without inhibiting the enzyme activity may be useful to prevent and/or treat SARS-CoV-2 spread in humans without increasing ACE2 expression in patients and therefore increased risk for COVID-19. In table-3 a list of plants mentioned which have potential role in treating this deadly virus.

Harsingar (night jasmine or parijat) is distributed widely in sub-Himalayan regions, southwards to Godavari and also found in Indian gardens as ornamental plant. Giloy (Amrita or guduchi) is a large deciduous, extensively spreading climbing shrub found throughout India. Aloevera (ghrit kumari) is a well known medicinal plant with sharp pointed, lanced shaped and edged leaves having its origin in African content. Turmeric (circumin or haldi), is commonly used species in Indian subcontinent, not only for health but also for the preservation of food. Ashwagandha is known as adaptogenic herb with great immunity boosting properties. *Azadirachta* (Neem) with its centre of origin in southern and southeastern Asia is regarded as “village dispensary” in India and also a religious gift from nature. Red onion is a versatile vegetable, consumed fresh as well as in the form of processed products. Tulsi is the one of the most religious and medicinal plant in India and grown throughout the country from Andaman and Nicobar island to the Himalayas. *Cannabis* is a

plant of psychoactive drug and black pepper is a kind of household species used in India. *Gloriosa* is the native to Africa and South-East Asia. It is a national flower of Zimbabwe and the state flower of TamilNadu possess Colchicine alkaloid which has antimicrobial, antibacterial and antioxidant properties. *Vitex negundo* is a well-known herb in the ayurvedic and Unani pharmacopoeia also called Nirgundi, it is said to have originated in India and the Philippines and has antibacterial and anti-viral actions. Tea another common drink served throughout India has presence of polyphenols that are known to have antioxidant, antiviral and anti-inflammatory activities. *Zingiber* (Adarak) a well known spice possess antiviral activity against human respiratory syncytial virus (HRSV) and very potent in lung infections.

Today the need of the hour is to investigate these potential medicinal plants against this COVID-19 virus for preparing life saving drugs and also to identify and grow these medicinal plants in our country. Some of these plants belong to rare or endangered category. National Medicinal Plant Board and Ministry of Ayush and department of Rural, Govt. of India, have launched a flagship program to grow medicinal plants on a big scale in India. Government aims to promote R&D in all aspects of medicinal plants, development of agrotechniques, post-harvest management, storage and processing, developing molecular characterization tools etc. and promotion of IT in this sector to save mankind in this era.

Considerations:

Despite the promising possible anti-SARS-CoV-2 effects exhibited by both plant extracts and natural molecules, several limitations should be considered. Overall, due to the recent outbreak, the clinical usefulness of these products needs to be demonstrated since the current data are still immature, and no final conclusions have been validated. In spite of that, these plants are currently used to treat or manage symptoms reported in SARS-CoV-2 disease such as fever, inflammations, or cardiovascular and circulatory disorders. Moreover, efficacy and safety of the active natural products should be further studied *in vivo* and clinically validated in COVID-19 patients. Importantly, bioavailability, modes of administration, safe doses, time of exposure, pharmacokinetic profile, the health of the patients' digestive system, and disease stage are to be considered in the evaluation of the beneficial effects of natural products against SARS-CoV-2. Assessing the effects of combinations of active natural products with validated antiviral drugs could be a promising alternative to explore.

Conclusion:

Medicinal plants and natural products are still considered promising alternatives to prevent or treat several diseases. Since the outbreak of the COVID-19 pandemic in December 2019, various traditional herbal medicines have been used and resulted in positive health effects among COVID-19 patients. Although the studies evaluating the anti-SARS-CoV-2 effects of medicinal plants are still insufficient and relatively immature, some natural products with IC_{50} below 10 μM could be considered as promising anti-SARS-CoV-2 agents since they were able to block its life-cycle related proteins such as the cellular receptor ACE2, papain-like or chymotrypsin-like proteinases. Nevertheless, several limitations have been detected in relation to the specificity of the action exerted by such products, sustainable sourcing of the species, doses range used, or the use of appropriate controls. Furthermore, the bioavailability of natural products with possible anti-SARS-CoV-2 effects such as tannins should be considered besides the need for clinical validation of their usefulness and safety. The herbal mixtures, medicinal plants or natural products with possible anti-SARS-CoV-2 effects must be evaluated through prospective and interventional studies. A combination of natural products or herbal mixtures with validated anti-COVID-19 drugs may constitute a promising preventive and therapeutic alternative to be assessed. Thus natural products hold a great promise for drug development against CoV and require greater attention to the agents that have already been shown to exhibit potent activity against various strains of CoV.

Test	Mechanism of Detection	Testing material	Availability for POC	Positive Test Indicates	Use of tests
Nuclieic acid amplification tests (NAAT)	RT-PCR and NGS detection of genetic sequence of conserved region for regions of the virus. E.g. N, E, S and RdRP genes. Two independent sequences need to be detected	Ambulatory: nasopharyngeal swabs, sputum. In hospital: sputum, endotracheal aspirate, BAL, blood, feces	No: Needs to be performed in the lab	Confirms current SARS-CoV2 infection	Individual testing
Antibody based immunoassay	ELISA detecting IgM or IgG ani-SARS-CoV-2 antibodies	Serum	Yes (depending on test design)	IgM+: 3-5 days post onset IgG: past infection	Overall infection/immu nity rates in a community
Antigen based immunoassay	ELISA detecting viral proteins. E.g. S (spike protein) or N protein (nucleocapsid)	Nasopharyngeal swabs, sputum and other lower respiratory tract secretions, BAL blood, feces.	Yes (depending on test design)	Confirms current SARS-CoV2 infection	Individual testing
Clinical tests	Clinical symptoms (fever/cough) Epidemiological history Imaging (CT)	CT – detection of radiological features	Yes	Infection Possible	Triage to identify candidates for further testing

*Lateral flow assay based on CRISPR-cas technology in under development for diagnosis of COVID-19 and is expected to be highly sensitive and cost-effective

Source: The European Society of Cardiology

Table-3 List Of Plants having Anti-Viral Properties

S. No	Botanical name	Common name	Family	Active compund	Action on Virus
1.	*Adhatoda vasica*	Adoos, Adulsa	Acanthaceae	Vasicine, Quinazoline	Inhibitor of Covid-19 protease, lung and bronchiole disorders
2.	*Allium cepa*	Red onion	Amaryllidaceae	Quercetin	Checks virus multiplication, HIV-PR
3.	*Aloevera*	Ghritkumari	Asphodelaceae	Aloenin, Aloesin	3 CL protease inhibition
4	*Andrographis paniculata*	Kalmegh	Acanthaceae	Andrographolide	Chronic fever, anti-viral, ACE inhibitor
5	*Artemisia annua*	Agnidamini, Majtari	Asteraceae	Artemisinin	Inhibition of Vira-protease
6	*Azadirachta indica*	Neem	Meliaceae	Nimbin	Inhibits viral entry
7	*Camellia sinensis*	Black Tea	Theaceae	Theaflavin digallate	SARS-CoV
8	*Cannabis sativa*	Bhang	Cannabeaceae	Cannabidiol	Blocks viral entry
9	*Curcuma longa*	Haldi	Zingib eraceae	Curcumin	SARS-CoV
10.	*Cynara scolymus*	Hathichuk	Asteraceae	Lupeol, Sabinene	Inhibitory action towards HCOV-NL63, HIV-1
11.	*Dioscorea batatus*	Potato Yam	Dioscoreaceae	Diosgenin	Protease inhibition
12.	*Gloriosa superba*	Kalihari	Colchicaceae	Colchicine, Gloriocine	Anti-viral
13.	*Nyctanthes arbotristis*	Harsingar	Oleaceae	Nictoflorin, Astragalin	Blocking viral entry
14.	*Ocimum sanctum*	Tulsi	Lamiaceae	Ursolic acid, Apigenin	SARS-CoV, anti-viral properties
15.	*Piper longa*	Black Pepper	Piperaceae	Piperine	3CL protease inhibition.

S. No	Botanical name	Common name	Family	Active compund	Action on Virus
16.	*Tinospora cordifoila*	Giloy, Amrita	Menispermaceae	Berberine, Sitosterol	Inhibitory to viral protein
17	*Tylophora indica*	Antmool	Asclepiadaceae	Tylophorine	Inhibition of viral replication
18.	*Vitex negundo*	Nirgundi	Lamiaceae	Hyoscyamine, Benoquinone	Inhibition of ACE
19.	*Withania somnifera*	Ashwagandha	Solanaceae	Withanolide, Withaferin A	Immunity boosting,Inhibitory to viral entry
20.	*Zingiber officinale*	Ginger, Adarak	Zingiberaceae	Gingerol, Shogaol	Respiratory infections

1. Adhatoda 	**2. Allium** 	**3. Aloevera** 	**4. Andrographis** 
5. Artemisia 	**6. Azadiracta** 	**7. Camellia** 	**8. Cannabis** 
9. Curcuma 	**10. Cynara** 	**11. Dioscorea** 	**12. Gloriosa** 
13. Nyctanthes 	**14 Ocimum** 	**15. Piper** 	**16. Tinospora** 
17.Tylophora 	**18.Vitex** 	**19. Withania** 	**20. Zingiber** 

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7. Novel Coronavirus (SARS-CoV-2): A Pandemic Era

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Abstract:

SARS-CoV-2 belongs to the betacoronavirus genus. Betacoronaviruses infect mammals, are zoonotic pathogens, and can cause severe respiratory disease in human being. Till date there are no drugs or vaccine to control the infection of this pandemic disease. Alternatively few drugs like anti-viral, anti-malarial and antibiotic, plasma therapy and other traditional system of medicine (Ayurveda and Homeopathy) are used against pandemic COVID-19 disease. The success of herd immunity depends on the higher proportion of the population that must be immune in order to stop an epidemic. An epidemic dies out when an average infection can no longer reproduce it. This occurs when large fraction of an infected hosts contacts is immune this threshold between where an infection can and cannot reproduce itself defines the fraction of the population required for heard immunity.

Keyword:

Virus, Covid-19, SARS-CoV-2, herd Immunity, RT-PCR, Rapid Antigen Testing.

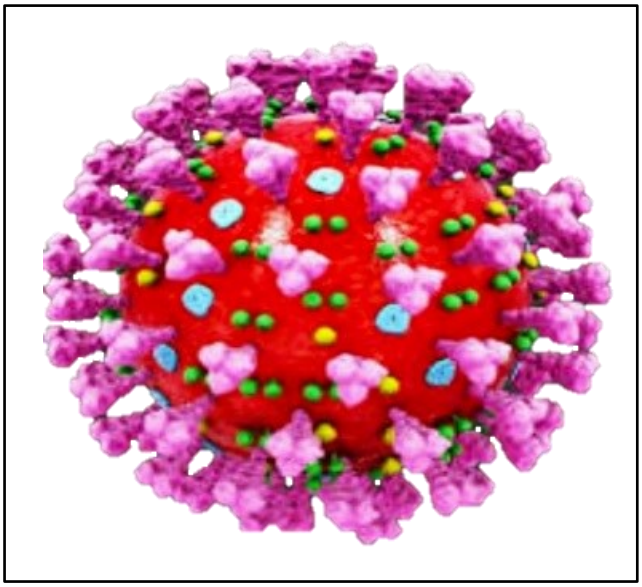
Introduction:

A Pandemic Era of 21st century- Human beings has been affected with several bacterial and viral outbreaks, epidemics and pandemics since time immemorial. Three deadly epidemics/pandemics have occurred during 18th-20th century: the great plague of Marseille, 1720; the Asian cholera, 1817-1824; and the Spanish Flu, 1918-20. Three deadly virus diseases have plagued humankind in the 21st century- Severe Acute Respiratory Syndrome (SARS, 2002), Middle East Respiratory Syndrome (MERS, 2012) and the nCoronavirus disease (COVID-19, December 2019-to till date). The COVID-19 pandemic is the heart-breaking global health crisis of our time. Emerging from late last year in Asia, the virus has

spread to every continent except Antarctica. Though it's not as deadly as SARS or MERS, it's much more contagious. This Virus has affected many lives from locality to global.

Current Scenario - As on 3rd September 2020, reported number of confirmed cases was 26.1M with 864K deaths globally. Same day India has reported 3.85M confirmed cases with 67K deaths. Considering the low testing capacity and restricted testing strategy in many countries, number of confirmed cases and deaths is likely underreported.

On February 11, 2020 the International committee on Taxonomy of viruses named the virus 'severe acute respiratory syndrome ncoronavirus (SARS-CoV-2). Picking up a formal name for the novel coronavirus and the disease it caused is conductive to communication in clinical and scientific research.The virus belongs to the β- coronavirus family, a large class of viruses that are frequent in nature. Like other viruses, SARS-CoV-2 has many potential natural hosts, intermediate hosts and final hosts. These cause major challenges for the prevention and treatment of viral infection (Wang L. et al. 2020).



Compared with severe acute Respiratory Syndrome and Middle East Respiratory Syndrome Coronavirus (SARS-CoV and MERS-CoV, respectively), SARS-CoV-2 has highly transmissibility and infectivity, and a low mortality rate (Liu et al., 2020).

Travel Genome analysis of SARS-CoV and bat SARS coronavirus (SARSr-CoV-RaTG13) were 79.5% and 96%, respectively (Chen et al., 2020). This implies that SARS-CoV-2 might originate from bats.

1. Genetic structure and pathogenic mechanism of SARS CoV-2:

nCoronavirus are enveloped, non-segmented, positive- sense single-stranded RNA viruses (ssRNA virus) with a diameter of 80-120nm.They have the largest genome among all RNA viruses (Wang L. et al., 2020). There are four types of viruses namely α-coronavirus, β-coronavirus, δ-coronavirus and γ- coronavirus. Prior to SARS-CoV-2, six coronavirus were now known to cause disease in human beings, including SARS-CoV and MERS-CoV. SARS-CoV-2, like SARS-Cov and MERS-CoV, belongs to the family of β-coronavirus.The genome is packed inside a helical capsid formed by the nucleocapsid protein and later surrounded by an envelope. The genome sequence homology of SARS-CoV-2 and SARS is approximately 79%; SARS-CoV-2 is closer to the SARS- like bat coronavirus (MG772933) than SARS-Cov (Wu et al., 2020), which descended from SARS-like bat coronavirus. Interestingly, several analyses have shown that SARS-CoV-2 uses angiotension- converting enzyme 2(ACE2) as its receptor, in common with SARS-Cov (Hoffmann et al., 2020).

Very recently, we published a review on nCoronavirus and mentioned that Covid-19 belongs to the Category- Coronaviruses; Order- Nidovirales; Family-Coronaviridae; Genus-Betacoronavirus; Species- SARS-CoV2. Betacoronaviruses can infect mammals, are zoonotic pathogens, and can cause severe respiratory disease in humans (Kaushik & Singh, 2020). Other viruses in this family are SARS coronavirus and MERS coronavirus. Covid-19 (SARS-CoV-2) has approximately 79% sequence identity to SARS-CoV and 50% to MERS-CoV. Fehr et al., (2015) published a research paper on Coronaviruses: an overview of their replication and pathogenesis in Methods Mol Biol. They report that Covid-19 (SARS-CoV-2) virus consists: a spike (S) protein, dimer (HE) hemagglutinin-esterase, a membrane (M) glycoprotein, an envelope (E) protein, a nucleocapsid (N) protein and ssRNA- Single standard ribonucleic acid (Figure-1).

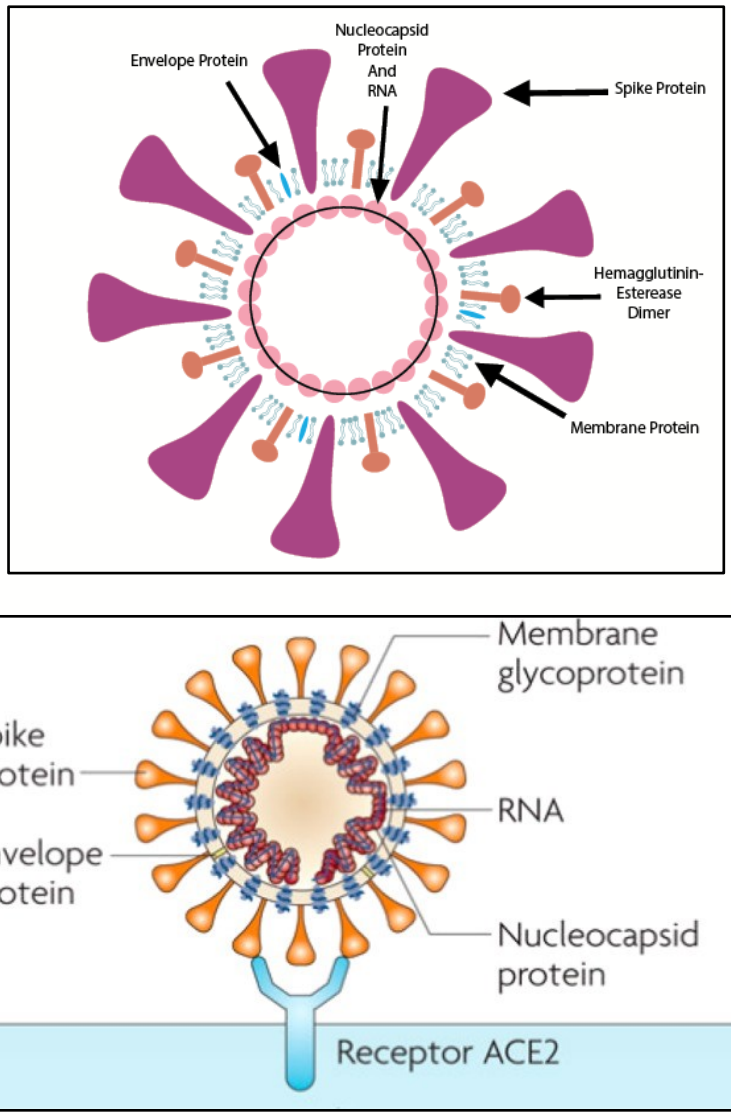


Figure-1-nCoronavirus structure with receptor ACE2

Spike protein (S) - The surface of the spikes is homotrimers are mainly glycosylated. Trans membrane protease serin type 2 (TMPRSS2) [6] composed of two separate polypeptides S1 and S2, respectively. The subunit S1 form head of the spike has a receptor binding domain which ultimately binds to nCoronavirus host receptor ACE2. Subunit S1 triggers a conformational change in (S) protein and promotes membrane fusion with the help of Subunit S2.

ssRNA are largest of all RNA virus genome (single standard RNA genome) about ~27-32 Kb in size.

Nucleocapsid protein (N protein) is abundant phosphoprotein. N proteins contribute only protein with N-terminal and C-terminal. It binds the ssRNA genome in beads on a string type conformation.

Envelope protein (E) is the smallest (max. 109 amino acid) structural protein. It involves in various ways such as assembly, budding and formation of envelop etc. Envelop proteins E may oligomerize and form ion channel. This virion goes for pathogenesis.

Membrane protein (M) is the most abundant transmembrane (III) glycoprotein. It contains approximately 230 amino acids. It does not contain signal sequence and exists as a dimer in the virion. Glycoprotein M maintains the bioactive and antigenic character. It may have two conformations (long & compact) to onset and promote membrane curvature to bind with nucleocapsid.

Hemagglutinin-esterase dimer protein (HE) is present in N-coronaviruses. The HE protein attached with sialic acids receptor present on surface host cell surface. The protein activities are enhanced through S protein-mediated cell entry and virus spread by mucosa of the host (Kaushik and Singh, 2020; Lu et al., 2020).

nCoronavirus strongly recognize its corresponding receptors on target cells through S-proteins on their surface; entry to the cells finally results in infection. Phylogenetics analyses undertaken with available full genome sequences suggest that bats appear to be the reservoir of COVID-19 virus, but the intermediate hosts has not yet been recognized.(World Health Organisation,2020). A structure model analysis shows that SARS-CoV-2 binds to ACE2 with more than 10-fold stronger affinity than SARS-CoV, at a level above the threshold required for virus infection (Wrapp et al., 2020).

The mechanism by which SARS-CoV-2infects humans beings via binding S-protein to ACE2, the strength of the interaction for risk of human transmission, rate of infection, and how SARS-CoV-2 causes different body organ damage still remain unfold, more research, data and studies are needed. On the basis of several results it comes to know that faster transmission capability of SARS-CoV-2 in humans compared with SARS-CoV, and higher number of confirmed cases worldwide of COVID-19 compared with SARS-CoV infection. Considering the higher affinity of SARS-CoV-2 binding to ACE2 may be a potential candidate for the treatment of COVID-19 (Wang L., et.al. 2020).

2. Transimission of SARS-CoV-2:

On the basis of previous epidemiological results it revealed that there are three factors involved in rapid spreading of viral: source of infection, route of transmission and susceptibility (Barreto et al., 2006). The case for SARS-CoV-2 described briefly below-

2.1. Source of infection:

Bats are considered to be the natural hosts of SARS-CoV-2, and pangolins and snakes are thought to be intermediate hosts, however some of the studies deny that snakes are host. A study from Wuhan Institute of Virology showed 96.2% similarity in the gene sequence between SARS-CoV-2 and bat coronavirus with the help of sequencing technology. This subsequently implies that bats are the potential source of SARS-CoV-2 (Zhou et al., 2020). By macrogenomic sequencing, molecular biological detection and electron microscope analysis, found 99% similarity between SARS-CoV-2 isolated from pangolins and the virus strains currently infecting humans beings (Xu et al., 2020).

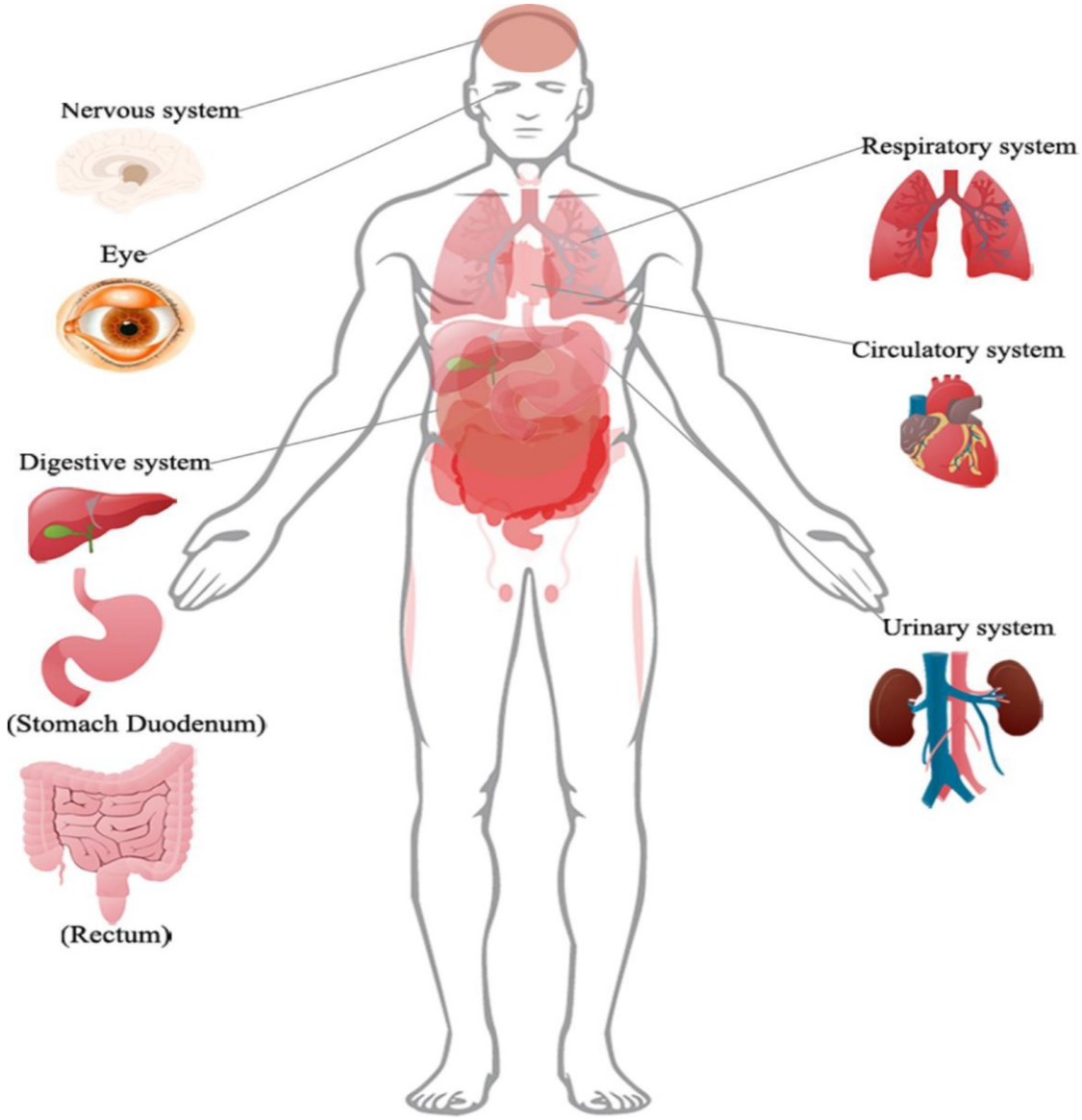


Fig. 2. Organ involvement confirmed by clinical features or biopsy in patients with COVID-19. Source - https://doi.org/10.1016/j.ijantimicag.2020.105948

Bats are the potential natural reservoir and pangolins as the possible intermediate host of the virus. Although no studies to date have fully elucidated the potential natural host and intermediate host of SARS-CoV-2, evidence shows that the virus might be sourced from wild animals (Wang L., et al., 2020). On the basis of data and result at present, it is considered that the main source of infection of SARS-CoV-2 is patients with COVID-19. However, question remains unanswered whether these patients are infectious during the incubation period.The median time from exposure to onset of symptoms suggests that the 14-Day quarantine period recommended by the WHO and other organisations are reasonable.

2.2 Route of transmission:

Droplets and close contact from person to person (about 6 feet/1.8 metres) are the most common routes of transmission of SARS-CoV-2, person-to-person spread mainly occur via respiratory droplets when an infected person coughs or sneezes, and aerosol transmission may be another route. Researchers have also investigated SARS-CoV-2 in samples of stool, gastrointestinal tract, saliva and urine. Based on bioinformatics, evidence has indicated that the digestive tract may be a route of SARS-CoV-2 infection (Wang J. et al, 2020). SARS-CoV-2 RNA has been detected consistently in gastrointestinal tissue from patients with COVID-19. Also in research, SARS-COV-2 was detected in the tears and conjunctival secretions of patients with COVID-19. In a study of nine pregnant women with COVID-19 indicated that the possibility of intrauterine vertical transmission between mothers and infants during late pregnancy was temporarily excluded. However, available data on pregnant women infected with SARS-CoV-2 are inadequate; further studies are required to verify the possibility of vertical transmission in women (Wang L. et al., 2020). Also, there is rare expectation when breastfeeding or feeding expressed breast milk is not recommended. Given low rates of transmission of respiratory viruses through breast milk, the World Health Organisation currently states that mothers with COVID-19 can breastfeed.

2.3 Susceptible Population And Viral Latenc:

An epidemiological investigation report stated that old aged people are most susceptible to SARS-CoV-2 (median age at death 75 years), and most of the patients who died had severe medical problems or a history of surgery before admission (Wang, W. et al., 2020). During research according to data collected it was found that, median incubation period was 3 days (range0-24days), and the median time from symptom onset to death was 14 days. For SARS-CoV infection, the median latency was 4 days, the average interval from symptom to hospital admission was 3.8 days, and the average interval from hospital admission to death was 17.4 days (Lessler et al., 2009). The incubation period for COVID-19 is quit shorter than that for SARS. However, the maximum latency of SARS-CoV-2 currently observed is as high as 24 days, which may increase the higher risk of virus transmission and more and more people will be susceptible to this. Further, people aged≥70 years had a shorter median interval(11.5 days) from symptom to death compared with patients aged <70 years (20 days), revealing, that disease progression is more rapid in elderly people as compared to younger ones. So definitely, our focus should be on elderly people who might be more vulnerable to

SARS-CoV-2. Also, people of any age are at increased risk of severe illness from COVID-19: Cancer, Chronic Kidney disease, COPD (chronic obstructive pulmonary disease).

3. Clinical Characteristics Of SARS-Cov-2 Infection:

SARS-CoV-2 produces an acute viral infection in humans with a median incubation period of 3 days (Guan et al., 2020); this is similar to SARS-CoV with an incubation period of 2-10 days. The most common symptoms of COVID-19 are fever (87.9%), cough (67.7%), and fatigue (38.1%), diarrhoea (3.7%), and vomiting (5.0%) are rare, loss of smell, similar to other coronavirus infections. The disease may also occur with mild symptoms only, including low fever, cough, sore throat, being tasteless (In India some of the reported cases it was found that a person infected to COVID-19 lost its taste without any other symptoms) shortness of breath or difficulty in breathing. Risk factors for illness are yet not clear. Disease in children appears to be rare and mild with 2.4% of the total reported cases among individuals aged less than 19 years. A small number of populations of those aged fewer than 19 years have developed severe (2.5%) or critical disease (0.2%) (World Health Organization, 2020). In a research there is evidence that COVID-19 can cause damage to not only lungs but also tissues and organs. Also, there is an evidence of ocular surface infection in patients with COVID-19, and SARS-CoV-2 RNA was detected in eye secretions of patients (Ai et al., 2020). Tissues samples of stomach rectal mucosa and duodenum have also been tested positive for SARS-CoV-2 RNA (Xio et al., 2020). In addition, the radiographic features of coronaviruses are similar to those which are found in community-acquired pneumonia caused by some other organisms (Wong et al., 2003). The most important tool to diagnose this pneumonia is computed tomography (CT) scan. A recent study observed that most of the patients about (90%) had bilateral chest CT findings, and the sensitivity of chest CT to suggest COVID-19 was 97%. Having chest CT imaging features with clinical symptoms could facilitate early diagnosis of COVID-19 pneumonia. If we compare with bacterial pneumonia, patients with COVID-19 had a lower oxygenation index. Laboratory observations states that 82.1% of patients were lymphopenia and 36.2% of patients were thrombocytopenic (Wang L. 2020).

4. Diagnosis Of SARS-Cov-2:

The detection of viral nuclei acid is the standard for non-invasive diagnosis of COVID-19. Also, the detection of SARS-CoV-2 nuclei acid has high specificity and low sensitivity, so it may be possible false- negative results and the testing time may be relatively long (Wang L.

2020). Experts to understand the two main kinds of tests for COVID-19 diagnosis and their reliability, according to experts, all the tests available in the market for testing COVID-19 have their own pros and cons but RT-PCR remains the best standard for testing.

4.1 RT-PCR (Reverse Transcription- Polymerase Chain Reaction):

This test has high specificity rate; gives less false positives, which is considered as the gold standard for testing. This test is performed by taking swabs from nasal and oral tracts both which are then put in viral transport medium and brought to the lab. It is then processed under the bio-safety level-2 plus facilities; then RNA extraction is done to detect the presence of the virus. RT-PCR test has a specificity (ability to identify those without the disease) of approximately 100 percent whereas, the sensitivity rate (ability to identify those with disease) of about 67 percent; subsequently, it means that RT-PCR test will not give false positives but there may be a chance of about 30-35 percent of getting false-negatives; there are mainly three reasons, first one is the technology itself which one cannot consider as limitations. Secondly, if the samples are not taken in a proper manner then the result can be a false-negative. This is the only reason why both nasal and oral swabs are taken. Thirdly, people are now seeing it as a preventive test means they are getting the test done without having any symptoms of COVID -19.

4.2 Rat (Rapid Antigen Testing):

It has a moderate sensitivity (around 50%) and high specificity which simply means if a test is done on 100 patients of COVID-19, it will give positive results for only 50 of them. According to ICMR, if RAT gives negative result but one has a symptom of influenza like illness, then one should undergo RT-PCR test. However, RAT has its own advantages that it can be done on a mass level. Now the number of tests being performed is about thousands.

4.3 Race For The Vaccine:

Scientists around the world are working on vaccines and medicines for COVID-19, More than 100 projects are on the way for development of vaccines. Russia reported its first vaccine on 11th August, 2020 named Sputnik-V. Strategies include attenuated strain vaccine, genetically modified and synthetic peptides vaccine, Nano particle based vaccine, self-amplifying RNA molecules etc. The vaccine, ChAdOx1 nCoV-19, is based on an adenovirus

vaccine vector and the SARS-CoV-2 spike protein. Its aim is to make body recognise and develop immune response to S protein thus preventing SARS-CoV-2 virus from entering human cells and therefore prevent infection. In India, Serum Institute of India, Pune has tied up with an American biotech company to develop a live attenuated vaccine. Hyderabad based Bharat Biotech has teamed up with university of Wisconsin Madison and a US based firm. If these trials are successful, a vaccine is expected by end of 2020 after the completion of protocols.

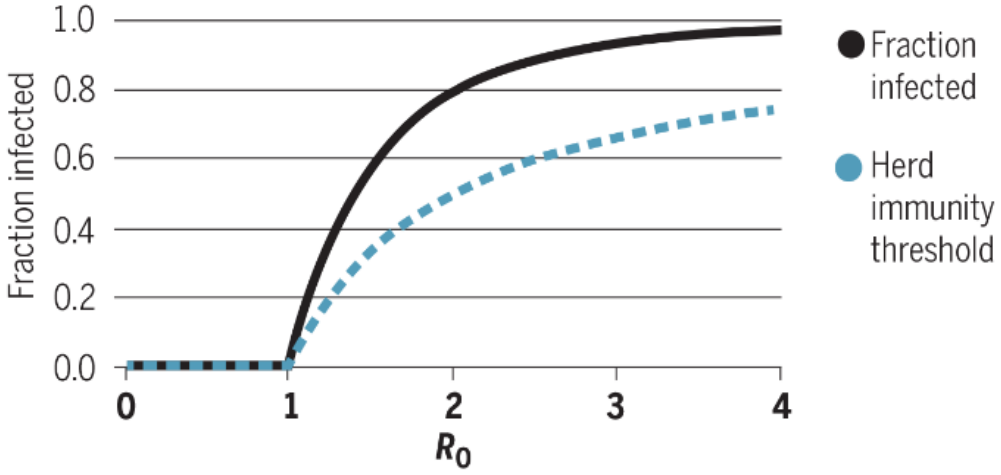
5. Herd Immunity Mathematics:

The early spread of Covid-19 has divulged critical information about potential size of the pandemic, if it were allowed to grow unchecked. This information can be mathematically studied with the help of mathematical modelling of infectious diseases. The total number of people infected in a population is determined by the intrinsic reproductive number, R_0. This number is the expected number of secondary cases caused by an index case in another susceptible population. Also, R_0 can be expressed as the transmission rate/ divided by the rate at which people recover or mortal. For accuracy describe R_0 in reference to a pathogen and host population, because the number is partially under host control. It also helps in determining the average long-term generality in the population, assuming new susceptible persons prevent the disease from dying out. As an epidemic increases and few of the population become immune, the average number of secondary cases caused by an infected person is called the effective reproductive number R_t. In India a decline trend in Covid-19 cases or a small spring to summer epidemic might be taken as evidence that interventions have been especially effective or that herd immunity has been achieved (Kaushik and Singh, 2020) (Figure -3).

An epidemic dies out when an average infection can no longer reproduce it. This occurs when large fraction of an infected hosts contacts is immune this threshold between where an infection can and cannot reproduce itself defines the fraction of the population required for herd immunity. It can be calculated precisely if the epidemiology of the pathogen is well known and is used to guide vaccination strategies. Herd immunity is constantly eroded by the births of new susceptible hosts and sometimes by the waning of immunity in previously infected host (Cobey, 2020).

Figure-3: Pandemic size and herd immunity

The fraction of the population that becomes infected with a transmissible disease in a simple epidemic model increases non-linearly with the intrinsic reproductive number R_0, and will exceed the threshold for herd immunity. R_0 is the expected number of cases caused an indexed case. Interventions can reduce R_0, the total fraction of the population infected, and the threshold for herd immunity.



Source: Cobey S. Modeling infectious disease dynamics. Science 24 April 2020, 10.1125/science.abb5659.

The durability of immunity to Covid-19 is not yet known till date, but births will promote virus survival. Thus like other transmissible pathogens, Covid-19 is likely to circulate in humans for many years to come. Steps taken by Indian Government are appreciable against pandemic Covid-19. The infection rate in India remains low relative with respect to large population size. Credit goes to fast action like Lockdown, physical distancing and susceptible people will be quarantine (Cobey, 2020).

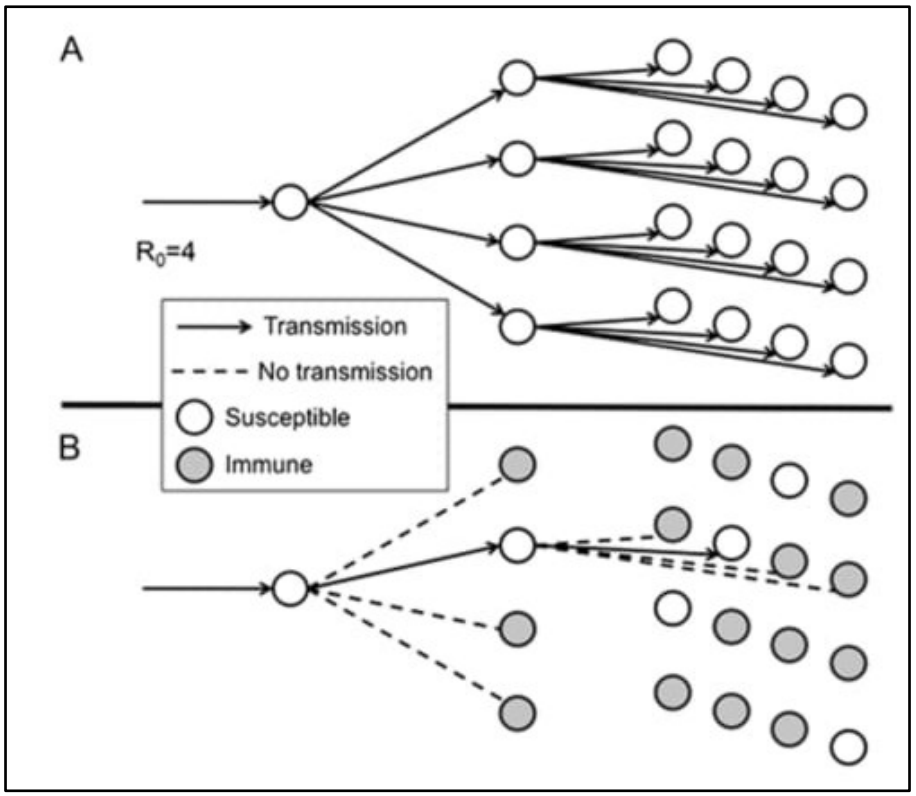


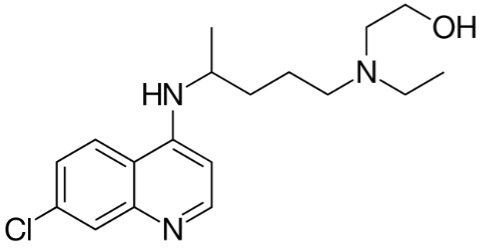
Fig.4- A- Transmission of disease with an R0 of 4 in a susceptible population.

B- Transmission of disease with an R0 of 4 in a population in which three of every four people is immune i.e. Rt in this latter scenario is equal to 1.

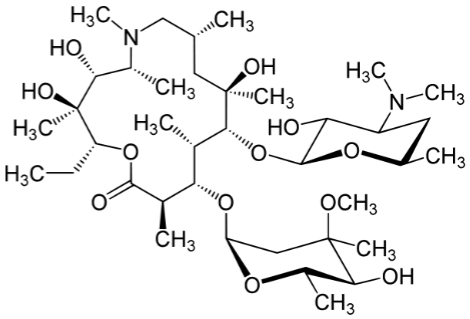
6. Drugs used in COVID-19:

Currently, there is no specific medicine or vaccine for the treatment of coronavirus. The US FDA has approved the antiviral compound, remdesivir, as an experimental drug for COVID-19. Remdesivir is supposed to accelerate the recovery of patients suffering from the disease, but the effectiveness of the drug is yet to be peer-reviewed. Favipiravir is the first approved nCoronavirus drug in China.

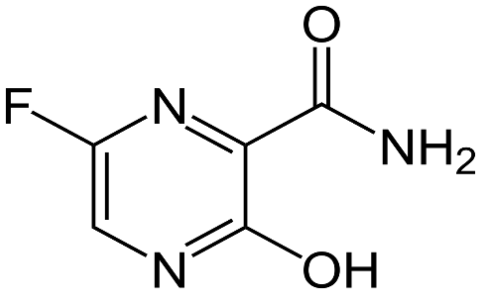
Azithromycin (AZ) is antibiotic unlike antiviral drug hydrochloroquine (HCQ) and used for the treatment of a number of bacterial infections. Chloroquine is also an effective anti-malarial drug and is included in World Health Organisation's list of essential medicines.



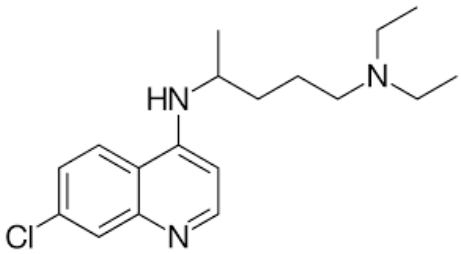
Hydroxychloroquine (HCQ)



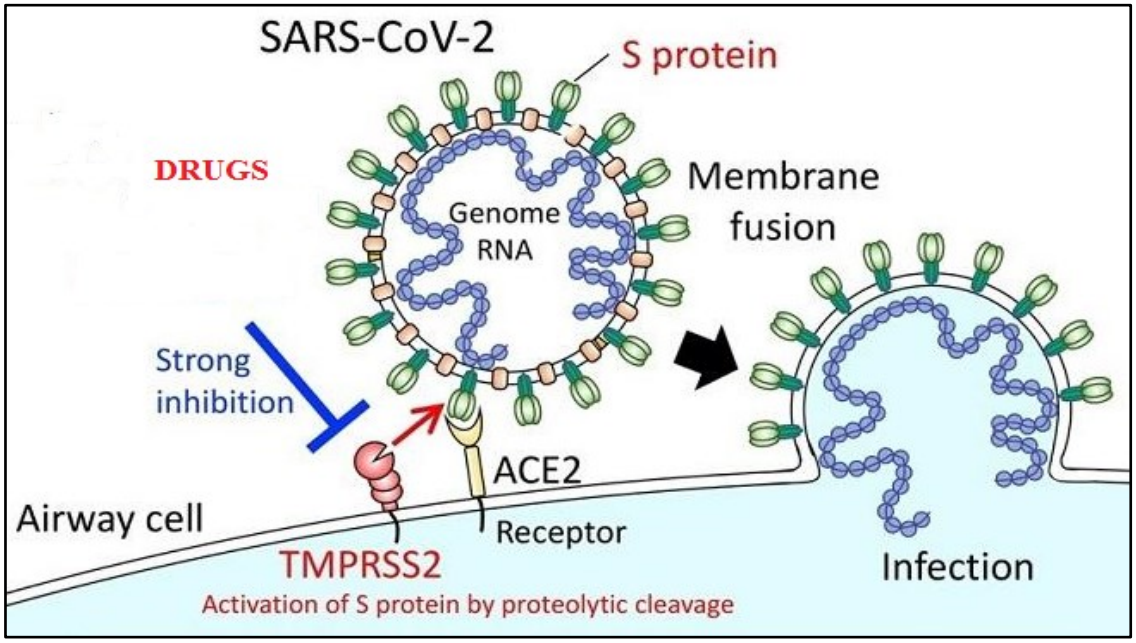
Azithromycin (AZ)



Favipiravir



Chloroquine



Drugs May Inhibits Entry Of SARS-Cov-2

7. Preventive Measures:

WHO (2020) reported that the corona viruses can mutate effectively, which makes them so contagious. To prevent transmission, people should stay at home and rest while symptoms are active. Prevention is, so far, the best practice in order to reduce the impact of COVID-19 considering the lack of effective treatment (Kumar, 2020). Ginnaro et al. (2020) suggested that at the moment, there is no vaccine available and the best prevention is to avoid exposure to the virus. In order to achieve this goal, the main measures are the following:

1. to use face masks;
2. to cover coughs and sneezes with tissues;
3. to wash hands regularly with soap or disinfection with hand sanitizer containing at least 60% alcohol;
4. to avoid contact with infected people;
5. to maintain an appropriate distance from people; and
6. to refrain from touching eyes, nose and mouth with unwashed hands.
7. Maintain at least 1 m (3.28 feet) distance between yourself and anyone who is coughing or sneezing.

8. Immune Booster Ayush Kadha:

Drink herbal tea/decoction (Kadha) made from Tulsi (*Ocimum sanctum*), Dalchini (*Cinnamomum tamala*), Kalimirch (*Black pepper*), Shunthi (*Gingiber officinale*) and Munakka (*Vitis vinifera*)- once or twice a day. Add jaggery (natural sugar) and/or fresh lemon (*Citrus limon*) juice to your taste, if needed.

Beside this Ministry of AYUSH also recommends the following self-care guidelines for preventive health measures. These are as follows-

1. Drink Cow Milk- Half tea spoon Haldi (*Curcuma longa*) powder in 150 ml hot cow milk- once or twice a day.
2. Drink warm water throughout the day.
3. Daily practice of Yogasana, Pranayama and meditation for at least 30 min.
4. Spices like Haldi (*Curcuma longa*), Jeera (*Cuminum cyminum*), Dhaniya (*Coriandrum sativum*) and Lahsun (*Allium sativum*) garlic are recommended in cooking.

5. Take Chyavanprash 10g in the morning. Diabetics should take sugar free.

9. Plasma Therapy:

Rojas et al. (2020) reported that the clinical administration of the blood plasma from recovered covid-19 patients to those severely affected by the disease could be a safe option without adverse effects, according to a study which may lead to better treatment protocols against novel corona virus infection. Salaza et al. (2020) reported in his research article that on March 28, researchers from the Houston Methodist Hospital in the US, began clinical trials to transfuse plasma from recovered covid-19 patients into critically ill patients and they noted that 19 out of 25 patients improving with the treatment and 11 discharged from the hospital.

The Economics Times (2020) reported in his news that physician scientists around the world scrambled to test new drugs and treatments against the COVID-19 virus, convalescent serum therapy emerged as potentially one of the most promising strategies. Salaza et al. (2020) also reported that the scientists in the century-old therapeutic approach dates back to at least as early as 1918 to fight the Spanish Flu by using convalescent serum therapy.

Casadevall and Pirofski (2020) reported that convalescent plasma therapy was used with some success during the 2003 SARS pandemic, the 2009 influenza H1N1 pandemic and the 2015 Ebola outbreak in Africa. They said early on in the Covid-19 pandemic, there were a handful of critically ill patients in China who showed improvement from plasma therapy, following which their team at Houston Methodist hospital targeted the Covid-19 virus with the procedure. Altair Data Analytics Summit (2020) clearly reported in his news that, it is not clear if the 25 patients given convalescent plasma would have improved without the treatment, adding that all patients were treated with multiple other medications, including antiviral and anti-inflammatory agents. “We cannot conclude that the patient outcomes were due solely to administration of convalescent plasma”. They said a randomized clinical trial would help address some questions, including whether patients would have better outcomes if plasma transfusions were administered sooner after the onset of symptoms.

10. Heating, Ventilation And Air Conditioning (HVAC) Systems:

Heating, ventilation and air conditioning (HVAC) systems and managing indoor air during the COVID-19 pandemic measures to improve indoor air quality focus on two processes: Air cleaning and ventilation. Air cleaning refers to the use of filters or air purifiers to catch indoor containments, including virus- containing particles. Most of the homes and buildings have filters as part of their HVAC systems.

Ventilation refers to the introduction of fresh outdoor air into an indoor environment. Through dilution, ventilation can lower the indoor concentration of containments, which also includes virus particles. At homes, ventilation can be improved by opening windows or doors so long as there is no safety risk to those inside the home. In kitchen and bathroom exhaust fans can also aid in improving in-home ventilation by adding to air exchange and directly removing air containments from a room.

11. Ecological Lessons and Conclusions:

The pandemic COVID-19 transmits a number of ecological and economic lessons for the future survivability of human beings. We must learn to live in harmony with nature. We need to possible implement for ecological conservation and restoration of nature. We need to revise urban planning; instead of invaded growing city areas and also we need to plan human habitation systematically in town. We need to setup a new model of economy beyond the model of globalised economy. Studies in this domain are urgently needed to minimize the impact of the outbreak. Over the last five decades the emergence of many different corona viruses that cause a wide variety of human diseases has occurred. It is likely that these viruses will continue to emerge and to evolve and cause human health outbreaks owing to their ability to recombine, mutate, and infect multiple species and cell types. Future research on corona viruses will continue to investigate many aspects of its replication and pathogenesis.

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