



Proceedings Book of the Vth International Symposium–2021
“Environmental Quality and Public Health”

May 20, 2021 Óbuda University, Budapest, Hungary

ISBN: 978-963-449-238-2.

www.iceee.hu

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HEALTHCARE AND TRANSMISSION OF PANADEMIC COVID-19

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Abstract: *The severe acute respiratory syndrome COVID-19 pandemic had a significant economic and social impact on the world. Since there is no effective medical treatment for COVID-19 at present, the international collaborative efforts are more focused on developing a safe and effective vaccine against COVID-19. This review explored various factors influencing the COVID-19 vaccination intention and the applicability of the health belief model to explore vaccination intention among the population of world. Increasing COVID-19 vaccine uptake among a larger section of the population is an important public health priority at the moment as many vaccine candidates approved for use have shown efficacy in preventing COVID-19 infection and associated complications. The COVID-19 pandemic has been a major challenge for healthcare systems throughout the world. Transmission of COVID-19 can occur through direct, indirect, or close contact with infected people through infected secretions such as saliva and respiratory secretions or their respiratory droplets, which are expelled when an infected person coughs, sneezes, talks or sings. The UNs WHO has described various levels of COVID-19 transmission. There is some evidence that the COVID-19 virus may lead to intestinal infection and be present in faeces. Approximately 2–10% of cases of confirmed COVID-19 disease presented with diarrhoea. In this difficult period it is best to meet virtually but if you have to meet others, do it carefully and with the right precautions. Further study should include the impact of COVID-19 vaccine uptake on these rates. Recent emergence and spread of variants have been reported with some concern regarding possible increased transmission and impact on immune responses. There is a real need for more studies regarding the public perception and acceptance of COVID-19 vaccines in the world.*

Keywords: *COVID-19, transmission, healthcare system, immune response, vaccination*

INTRODUCTION

The novel coronavirus named as SARS-CoV-2 has shaken the world by bringing the disastrous pandemic of the century. The COVID-19 pandemic has become one of the most alarming global health crises of our time. On 30 December 2019, the Program for Monitoring Emerging Diseases notified the world about pneumonia of unknown cause in Wuhan, China. Coronavirus is thought to be transmitted from animals (bats or civets) into the human race and began spreading. Since then, scientists have made remarkable progress in understanding the causative agent, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), its transmission, pathogenesis, and mitigation by vaccines, therapeutics, and non-pharmaceutical interventions. Yet more investigation is still needed to determine the origin of the pandemic. Theories of accidental release from a lab and zoonotic spreading both remain viable. Knowing how COVID-19 emerged is critical for informing global strategies to mitigate the risk of future outbreaks. In May 2020, the World Health Assembly requested that the

World Health Organization (WHO) director-general work closely with partners to determine the origins of SARS-CoV-2 (World Health Assembly Resolution 73.1, 2020).

Furthermore, the two theories were not given balanced consideration. Only 4 of the 313 pages of the report and its annexes addressed the possibility of a laboratory accident (WHO, 2021a). Notably, WHO Director-General Tedros Ghebreyesus commented that the report's consideration of evidence supporting a laboratory accident was insufficient and offered to provide additional resources to fully evaluate the possibility (WHO director-general's remarks, 2021). As scientists with relevant expertise, we agree with the WHO director-general (WHO, 2021b), the USs and 13 other countries (US Department of State, 2021), and the European Union (Delegation of the European Union, 2021) that greater clarity about the origins of this pandemic is necessary and feasible to achieve. It must take hypotheses about both natural and laboratory spreading seriously until sufficient data are collected. A proper investigation should be transparent, objective, data-driven, inclusive of broad expertise, subject to independent oversight, and responsibly managed to minimize the impact of conflicts of interest. Public health agencies and research laboratories alike need to open their records to the public. Investigators should document the veracity and provenance of data from which analyses are conducted and conclusions drawn, so that analyses are reproducible by independent experts.

The origin and early spread of COVID-19 remains shrouded in mystery. Here, data was identified a set containing COVID-19 sequences from early in the Wuhan epidemic that has been deleted from the NIH's Sequence Read Archive. It was recovered that the deleted files from the Google Cloud, and reconstruct partial sequences of 13 early epidemic viruses. Phylogenetic analysis of these sequences in the context of carefully annotated existing data suggests that the Huanan Seafood Market sequences that are the focus of the joint WHO-China report are not fully representative of the viruses in Wuhan early in the epidemic. Instead, the progenitor of known SARS-CoV-2 sequences likely contained three mutations relative to the market viruses that made it more similar to SARS-CoV-2's bat coronavirus relatives (Bloom, 2021).

The COVID-19 pandemic caused by a novel 2019 SARS coronavirus, known as COVID-19 which is rapidly spreading worldwide, greatly surpassing the 8,000 total cases of the 2002–2004 SARS coronavirus outbreak (SARS-CoV-1) after 1 month of the initially identified case on 31 December 2019, in Wuhan city, China (Wilder-Smith et al., 2020). As COVID-19 is human-to-human transmitted, it is a threat to the global population.

STRUCTURE OF COVID-19

The novel coronavirus disease (COVID-19) has spread worldwide, resulting in numerous cases of morbidity and death. According to transmission electron microscopy (EM) and cryo EM, the morphology of the COVID-19 particle is round, oval or pleomorphic, with a diameter of 60–140 nm. COVID-19 virions have distinct spikes, protruding approximately 9 to 12 nm from the membrane surface that give virions the appearance of a solar corona or medieval crown and hence gave this virus family its name (Lu et al. 2020; Zhou P et al. 2020; Zhu et al. 2020).

The composition of envelope of coronavirions is reminiscent to the membrane of the former host cell, comprising membrane proteins and lipid bilayers. Klein et al. measured the lipid bilayer separation of SARS-CoV-2 virions: a phospholipid monolayer separation was 3.6 nm whereas the plasma membrane was 3.9 nm (Klein et al. 2020). The structure of the nucleocapsid is a symmetrical helix, formed by the combination of positive-strand RNA and nucleocapsid protein (N) (Peiris et al. 2004).

The single-stranded RNA genome of the COVID-19 reference sequence is 29,891 nucleotides in size and encodes 9860 amino acids. The G:C content is 38% (Chan et al. 2020). COVID-19 shows a genome organization typical for beta coronavirions: a 50 un-translated region (50-UTR), an RNA polymerase open reading frame (ORF1ab) followed by genes encoding for the spike (S) protein, the envelope (E) protein, the membrane (M) protein, the nucleocapsid (N) protein, a 30 un-translated region (30-UTR), and several non-structural open reading frames (Chan et al. 2020; Wu F et al. 2020; Zhu et al. 2020). The genome gives rise to at least 12 canonical proteins and 23 non-canonical translation products (Finkel et al. 2020).

According to GenBank, the protein lengths of these five important proteins are 7096 amino acids (ORF1ab), 1273 amino acids (S protein), 75 amino acids (E protein), 222 amino acids (M protein) and 419 amino acids (N protein).

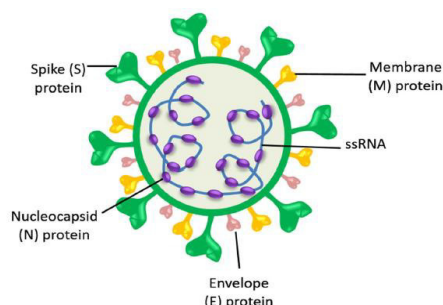


Figure (1) The genomic organization and structural features of COVID-19

The RNA polymerase gene occupies 67% of the coronavirus genome, while all other structural proteins and accessory proteins are encoded by the remainder of the genome (Chen Yu et al. 2020; Guan et al. 2003; Wu A et al. 2020). One study predicted putative functions and proteolytic cleavage sites of ORF1ab, including 16 non-structural proteins, by bioinformatics (Chan et al. 2020).

RECEPTORS OF COVID-19

The spike glycoprotein forms spikes on the surface of coronaviruses, attaching the viruses to host cell receptors and catalysing virus–cell membrane fusion. For this purpose, the receptor-binding domain (RBD) in the spike glycoprotein directly binds receptors on the surface of host cells. The amino acid sequences and predicted protein structure are highly similar between COVID-19 and SARS-CoV RBD, suggested that COVID-19 may also use human angiotensin-converting enzyme 2 (ACE2) as a cellular entry receptor, facilitating human-to-human transmission (Letko et al. 2020; Lu et al. 2020; Wan et al. 2020; Wu F et al. 2020; Zhu et al. 2020). It was found that COVID-19 can use all but mouse ACE2 as entry receptors (Zhou P et al. 2020).

It is critical to understand COVID-19 characteristics to deal with this ongoing pandemic and to develop future treatments. COVID-19 virion is an enveloped, positive-stranded RNA virion with a large genome (29.9 kb) belonging to the family Coronaviridae, order Nidovirales (De Wit et al., 2016). One of the striking genomic features of this novel virion is the presence of a novel furin-like cleavage site in the S-protein of the virion, which differs from SARS-CoV-1 and may have implications for the life cycle and pathogenicity of the novel virion (Coutard et al., 2020; Wu et al., 2020a).

Firstly, it was suggested that COVID-19 is a close relative of the RaTG13 bat-derived coronavirus (around 88% identity) rather than of SARS-CoV-1 (79% identity) or Middle East respiratory syndrome coronavirus MERS-CoV (50% identity) (Lu et al., 2020).

Due to this association with bat coronaviruses, it was argued that COVID-19 virion has the potential to spread into another species, as bat coronaviruses do (Hu et al., 2018). Although bats are likely natural reservoir hosts for COVID-19, it was recently demonstrated that COVID-19 is closely related to a pangolin coronavirus (Pangolin-CoV) found in dead Malayan pangolins with a 91.02% identity, the closest relationship found so far for COVID-19 (Zhang et al., 2020). In that study, genomic analyses revealed that the S1 protein of Pangolin-CoV is related closer to COVID-19 than to RaTG13 coronavirus. Also, five key amino acid residues involved in the interaction with the human ACE2 receptor are maintained in Pangolin-CoV and COVID-19, but not in RaTG13 coronavirus. Thus, it is likely pangolins are an intermediate host in the transmission of coronaviruses between bats and humans. In this manner, it was argued COVID-19 acquired mutations needed for human transmission and will continue to evolve with novel mutations, as the pandemic evolves (Zhang & Holmes, 2020). In this scenario, it is expected that diverse signatures of viral variants spread among different populations in the world.

Recently, thousands of GenBank sequences from SARS-CoV-19 available at the NCBI virus database were trackable by region, suggesting that the transmission occurred mainly through clonal events due

to clustering of the available sequences (Chen et al., 2020; Kupferschmidt, 2020). As a proof of concept, in the early beginning of the outbreak in China, sequencing the virus from nine patients from Wuhan in China revealed 99.9% similarity among samples.

That finding suggests 2019-nCoV originated from one source within a very short time, supporting clonality of spreading (Lu et al., 2020). Coronavirion Disease 2019 (COVID-19) is caused by severe acute respiratory syndrome Coronavirion 2 (SARS-CoV-2) and it was declared a public health emergency of global concern on January 30, 2020 (WHO, 2020).

The disease has spread globally and an estimated 349 million peoples are at risk of the severe form of COVID-19 (Clark et al. 2020). Globally, as of May 14, 2021, more than 160 million confirmed cases and 3.3 million deaths have been reported to the World Health Organization (WHO) and the Americas, Europe and Southeast Asia were the most affected regions. However, South Africa, Nigeria, and Ethiopia were among the countries highly burdened by the COVID-19 pandemic in Africa (WHO, 2021).

TRANSMISSION OF COVID-19

Some of the countries that have been most successful at keeping COVID-19 at very low are now seeking ways to gingerly lower the barriers that protect them while minimizing the risk that the disease will become endemic. China, Australia, New Zealand, Singapore, and Taiwan all closed their borders last year and forced the few people allowed entering into strict hotel quarantines. Internally, they quashed outbreaks early, using lockdowns and other restrictions. As a result, residents could live near-normal lifestyles most of the time.

Countries with this “zero COVID-19” strategy, as it has been dubbed have generally fared better than countries that opt for mitigation. They found the elimination cohort had lower per capita death rates, shorter and less strict lockdowns, and faster economic recoveries than the mitigation camp, including the USs and Europe, which have used vaccines and other measures to try to blunt massive waves of infection. But the spread of the highly infectious Delta variant, the economic burden of closed borders, lockdown fatigue, and increasing vaccine availability are changing the equation. “In the long-term is not really economically sustainable. Countries are going to need to test out different approaches to find the right balance between infection prevention and control and normalizing societal activities.

COVID-19 is a highly communicable disease transmitted to susceptible individuals by respiratory droplets and nasopharyngeal secretion (Acter et al., 2020). Peoples infected with COVID-19 have been diagnosed usually by taking nasopharyngeal swabs or pharyngeal aspirates. These procedures are invasive and challenging both for health-care providers and patients.

However, there is evidence which indicates that patients infected with COVID-19 can be detected from saliva (Khurshid et al., 2020). All individuals infected with COVID-19 may not show clinical manifestations of the disease (Getaneh et al., 2020). Fever, cough, fatigue and dyspnea were the common symptoms observed in people infected with COVID-19 (Gulati, et al., 2020).

However, the severe form of the disease: acute respiratory distress syndrome, organ dysfunction and death could occur in the elderly and patients who have chronic disease concomitantly (Li et al., 2020). Cardiovascular, diabetic mellitus and chronic lung diseases were associated with COVID-19 illness and death (Stokes et al., 2020).

Several vaccines have been used worldwide to prevent COVID-19 despite other prevention strategies (WHO, 2021). However, there was no effective and approved drug to cure the disease. Thus, patients have been treated symptomatically with supportive measures (WHO, 2020). However, the clinical setups and level of supportive measures employed varied across countries and it mainly depends on economic status (Bong et al., 2020).

The African economy and healthcare system was significantly affected by the COVID-19 pandemic (Kanu, 2020 and Paintsil, 2020). This pandemic showed that the capacity of the countries’ healthcare system has to be enhanced. Besides, health policies should be modified and emergency preparedness strategies have to be strengthened to prevent and control public health emergencies (Xing and Zhang, 2021). The COVID-19 public health crisis has helped countries to revise their governance structures indirectly and to make some political reforms (Zhang and Zhang, 2020).

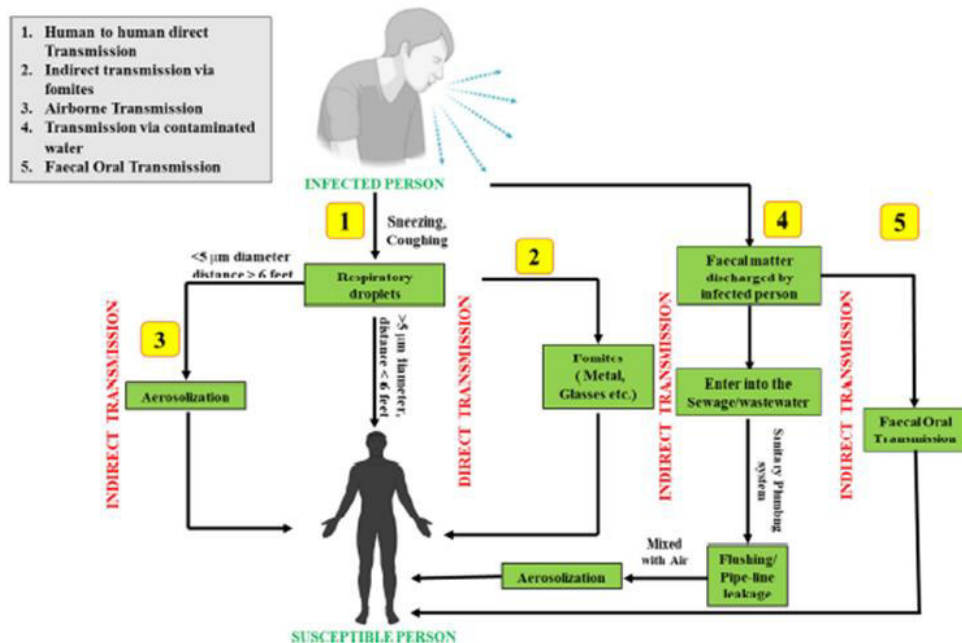


Figure (2) Different transmission pathways COVID-19 in the environment

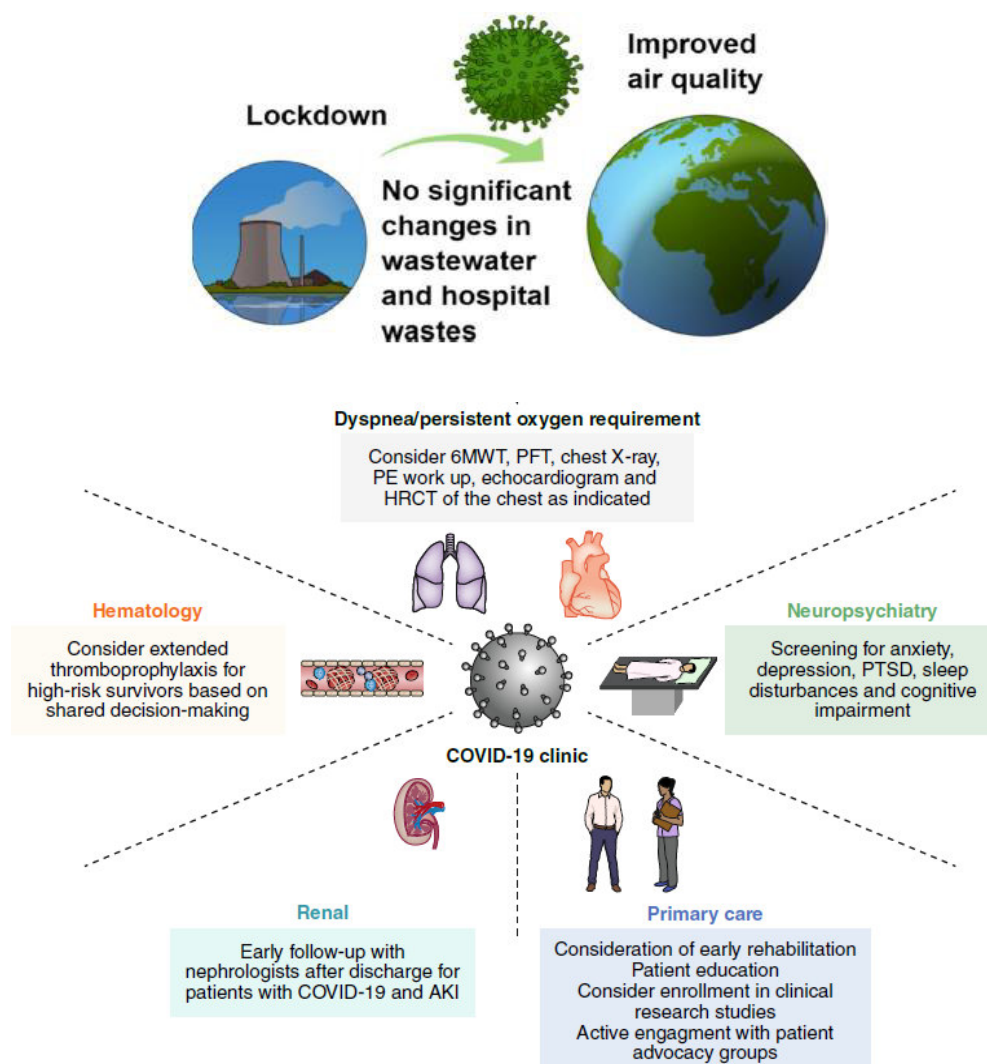


Figure (3) Interdisciplinary management in COVID-19 clinics

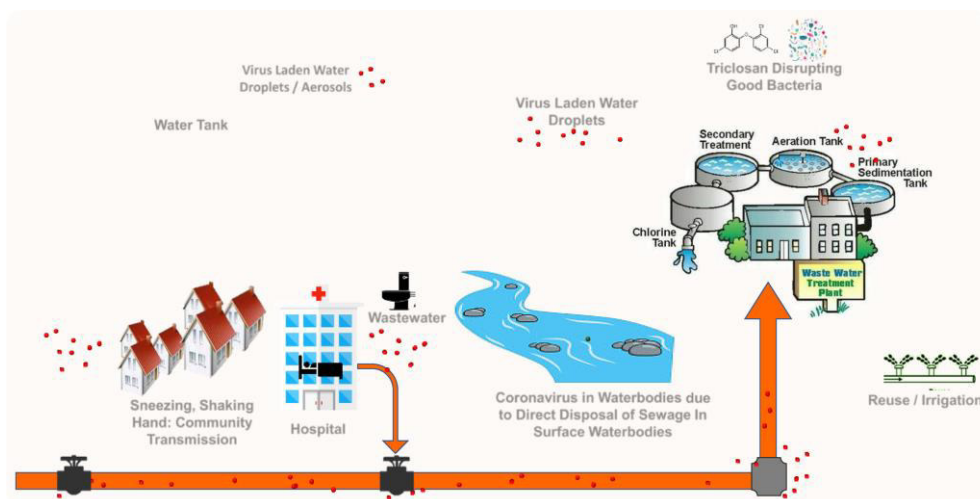


Figure (4) Occurrence, transmission, fate of Coronavirion in community

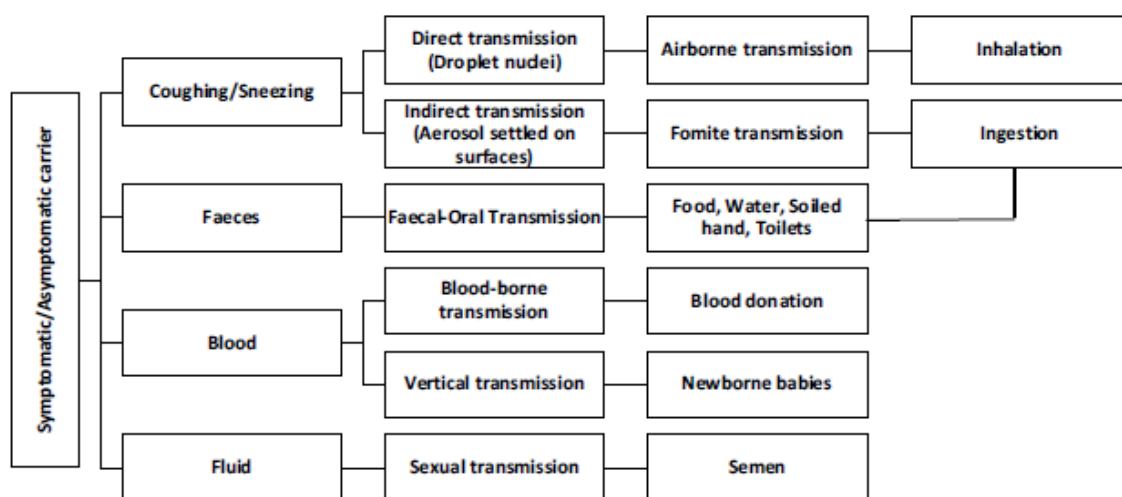


Figure (5) Flow diagram explaining different modes of transmission of SARS-CoV-2

REDUCTION OF VIRION TRANSMISSION

The COVID-19 virion will not stop entirely, unless people develop strong immunity against the virus, which would be achievable through proper vaccination that is specifically built to fight COVID-19. It is unlikely that even people with an open mind will accept a new vaccine that has not been tested for more than a year because they fear being one of the first to get vaccinated with this new vaccine.

To reduce transmission of COVID-19, primary prevention strategies are feasible and the best options in resource-limited settings (Ali and Alharbi, 2020).

Vaccination (A vaccine is a substance that stimulates your immune system to make antibodies (blood proteins produced in response to a foreign substance) as it would if you were exposed to the actual disease. After vaccination, human body develops immunity to the disease, so people are protected from getting sick if they are infected), maintaining physical distance, washing hands, staying home, and wearing face mask were the main measures recommended to prevent the disease worldwide (WHO, 2020). Globally, there are different commercially available antiviral solutions used to prevent COVID-19 infection during clinical practice in health-care settings, but many health-care providers had lack of awareness about the prevention benefit of those solutions (Imran et al., 2021).

Elderly populations are high risk groups for COVID-19 due to weakened immune status. Therefore, elderly populations are recommended to have awareness about the disease and they need to apply all the precautionary measures.

A study among the elderly population in China indicated that females had a higher level of understanding about COVID-19 than males and awareness was the main determinant factor to develop protective behaviors (Sun et al., 2020a). Perception of people about the COVID-19 pandemic was the main determinant factor to the utilization of preventive behaviors (Duan et al., 2020).

Generally, a systematic review and meta-analysis report revealed that more than two-thirds of study participants in the general population had good knowledge and favourable attitude toward the pandemic (Saadatjoo et al., 2019). However, adhering to COVID-19 prevention methods was not satisfactory despite the increment of cases and death in the country. Fear and anxiety are common experiences during a public health crisis and in the era of the COVID-19 pandemic. These problems were exacerbated in communities who lacked knowledge about the pandemic and COVID-19-related rumors and fake news contributed to the spread of the disease (Sun et al., 2020b; Orso et al., 2020).

DIAGNOSIS OF COVID-19

Diagnosis of COVID-19 needs a comprehensive analysis of epidemiological history and clinical presentation. Fever and dry cough were the common symptoms of a COVID-19 infection, while upper respiratory symptoms such as rhinorrhea were rare. Finally, nasopharyngeal swabs with positive viral RNA remain the gold standard for the diagnosis of COVID-19. In addition, RNA tests can also produce initially false negative results due to low viral load or the method of collecting nasopharyngeal swab specimens, so samples should be taken multiple times to confirm COVID-19. Besides, the serological testing of anti- COVID-19 immunoglobulin G (IgG) and/or IgM were widely used as a complement method in the diagnosis of COVID-19. As such, the eventual diagnosis of COVID-19 should be determined by a comprehensive analysis of CT imaging and blood test results.

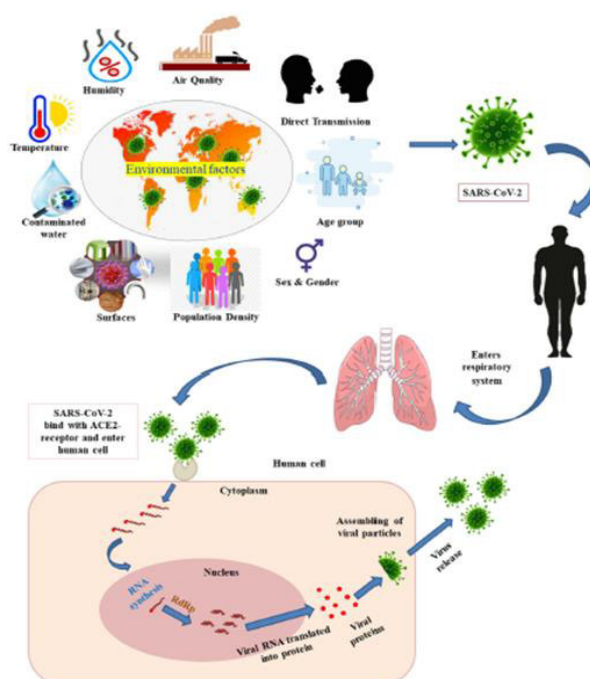


Figure (6) Influence of Environmental factors on THE infection OF COVID-19

HOW DO THE VACCINES WORK?

Two viral vectors are better than one?

Sputnik V is an adenovirus vaccine, which means that it uses an engineered adenovirus that generally cause only mild illness s a delivery mechanism for inserting the genetic code for the COVID-19 spike protein into human cells. It is similar to the Oxford–AstraZeneca and Johnson & Johnson vaccines.

But instead of using one engineered adenovirus, as those two vaccines do, Sputnik V uses different adenoviruses, called rAd26 and rAd5, for the first and second doses, respectively.

The two adenoviruses have slightly different methods of introducing their genetic material into a host cell, which would theoretically improve the success rate of getting the viral genetic material where it needs to go.

The two preliminary studies from the vaccine developers, published in September 2020², involved 76 healthy adults who received the two doses with different viral vectors three weeks apart. All participants produced antibodies to the COVID-19 spike protein, and adverse events reported were mainly mild pain at the injection site, fever, headache, fatigue and muscle aches — adverse events typical of other COVID-19 vaccines.

Pfizer and Moderna Vaccines

- The vaccines from Pfizer and Moderna use a technique known as messenger RNA (mRNA).
- These vaccines give instructions for our cells to make a harmless piece of what is called the 'spike protein.'
- This protein is found on the surface of the coronavirus that causes COVID-19.
- Once these vaccine instructions, or mRNA, are injected, your cells use it to make the spike protein; then the instructions are broken down and eliminated.
- The protein piece is displayed on the cell surface, triggering our immune system to make antibodies against it, just as it would if it were exposed to the real coronavirus that causes COVID-19.
- In this way, the body learns how to protect itself when and if the real virus shows up.
- The mRNA vaccines don't use the live virus that causes COVID-19, nor does the mRNA get into the cell's nucleus, which is where our DNA is stored.

Sputnik V, Oxford–AstraZeneca and Johnson & Johnson Vaccine

Sputnik V is an adenovirus vaccine, which means that it uses an engineered adenovirus (a family of viruses that generally cause only mild illness) as a delivery mechanism for inserting the genetic code for the COVID-19 spike protein into human cells.

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Johnson & Johnson Vaccine

- The vaccine from Johnson & Johnson is made using a type of virus called adenovirus type 26, or Ad26.
- The Ad26 delivers a piece of the DNA, used to make the spike protein, so the person can temporarily make this protein and teach the immune system to react against the coronavirus.
- Ad26 is modified so it can't make the person sick.

How many doses do you need?

- One dose for the J&J vaccine, and
- Two doses for the vaccines from Moderna and Pfizer and the others.

Right dose

- In the earliest trial of Moderna's mRNA-based vaccine, study participants received one of three dose levels: 25, 100 or 250 micrograms (Jackson et al., 2020).
- The top dose proved too toxic. The low dose elicited the weakest immune response. The middle dose seemed to offer the best balance: it triggered strong immunity and had acceptable side effects.
- That 100-microgram dose ultimately became the one authorized for mass use in dozens of countries. But Moderna scientists later showed that a half-dose seemed to be just as good as the standard dose at stimulating immune protection (Chu et al., 2020).

What is the interval between doses?

- For the Moderna vaccines, the two doses are given 4 to 6 weeks apart.
- For Pfizer's vaccine, the two doses are given 3 to 6 weeks apart.

What happens if you don't take the second dose?

- Protection is assumed to be less.
- In data that Moderna, its analysis suggested that the first dose provides protection from getting COVID-19, but the data did not allow for a "firm conclusion".
- Both the Pfizer and Moderna vaccines are believed to be around 50% effective after just one dose.

After the required doses, how long until it takes effect and provides protection

- That happens about a week after the second dose.
- Once the second dose kicks in, both the Pfizer and Moderna vaccines have shown in studies to be about 95% effective.
- The J&J effectiveness data was based on 28 days after the inoculation.

In case of Sputnik V, some of that concern was allayed when the phase III trial results (Logunov, 2021), published in February by the vaccine's developers, suggested that it is 91.6% effective at preventing symptomatic COVID-19 infection and 100% effective at preventing severe infection.

Despite the absence of approval from the EMA or the WHO, several countries, including South Korea, Argentina and India, are already manufacturing Sputnik V. And India plans to pump out at least 850 million doses, to help speed up the vaccination of its embattled population. Many other countries, such as Hungary and Iran, are importing Sputnik V, and it has become a key plank of their vaccination campaigns (Logunov, 2020).

Data from seven vaccination trials help to identify a blood marker for protection against the disease. After people have been vaccinated against COVID-19, the levels of infection-blocking antibodies in their blood are a strong indicator of how much protection they've gained against the disease, according to a modelling study (Khoury et al., 2021). The research showed that the presence of even small quantities of these potent 'neutralizing antibodies' indicates that a vaccine is effective at protecting against COVID-19. The study is the best attempt yet to define features of the immune response that can act as a proxy for protection against COVID-19, known as a 'correlate of protection'.

How long does the protection last?

- Because the vaccines are new, this is not yet known for sure.
- Based on other viruses that are similar to the coronavirus that causes COVID-19, the COVID-19 vaccines that are shown to be highly effective might protect people for a few years.

What about side effects?

People should expect to have some side effects, similar to what some people report after getting a flu vaccine. These experts said to expect temporary side effects such as soreness in your arm where you got the shot, fatigue, body aches, and perhaps a fever.

Sputnik's side effects are also becoming clearer; studies so far suggest that they are similar to those of the other adenovirus vaccines, with the notable exception of rare blood-clotting conditions. Unlike for both the Oxford–AstraZeneca and Johnson & Johnson vaccines, there have been no reports of these disorders from Russian health authorities or from the other nations using Sputnik V.

A preprint (Pagotto, V. et al., 2021) from the Italian Hospital of Buenos Aires in Argentina reported no cases of clotting disorders or adverse events of special interest among 683 health-care workers vaccinated with Sputnik V. And an analysis of 2.8 million doses of Sputnik V administered in Brazil reported no deaths associated with vaccination, and mostly mild adverse events. Furthermore, a study posted as a pre-print in May, from the republic of San Marino, found no serious adverse events in 2,558 adults who received one dose of Sputnik V and 1,288 who received two doses (Montalti, M. et al., 2021).

HOW WELL DO THE VACCINES WORK IN THE REAL WORLD?

In Denmark, a clinical trial (Polack et al., 2020) in more than 40,000 people had already found the vaccine to be 95% effective in protecting recipients from symptomatic COVID-19. But Moustsen-Helms, who works at the Statens Serum Institut in Copenhagen, and her colleagues were among the first to test its effectiveness outside clinical trials, which can exclude some unhealthy individuals or those taking medicines that suppress immune responses.

The results (Moustsen-Helms et al., 2021) showed it was 64% effective in long-term-care residents with a median age of 84, and 90% effective in healthcare workers, given that immune responses in older people can be muted.

Among older adults who received the Pfizer–BioNTech vaccine, Israel has seen 94% protection from COVID-19 infection in people over 85 years old (Haas et al., 2021). This is remarkably high for that age group, and considerably higher than Moustsen-Helms’s result of 64%, possibly in part because long-term-care residents are prone to be in poor health. Similarly, a UK study found that the Pfizer–BioNTech and Oxford–AstraZeneca vaccines were both 80% effective at preventing COVID-19 hospitalizations in people aged 70 or older (Bernal et al., 2021a).

Studies are under way to see whether vaccine effectiveness can be boosted even more by mixing and matching vaccines, and early results have been promising.

At the other end of the age spectrum, Pfizer–BioNTech and Moderna in Cambridge, Massachusetts, have recently completed clinical trials of their vaccines in adolescents, showing 100% and 93% protection in those aged 12–15 (Frenck et al., 2021) and 12–17, respectively.

Real-world data are not yet available. Initial laboratory tests suggested that antibodies raised by the Pfizer–BioNTech vaccine were less effective against the B.1.351 variant identified in South Africa, but it was unclear how that would affect protection against disease.

In May, researchers in Qatar published reassuring data showing that people who received two doses of the Pfizer–BioNTech vaccine were 75% less likely to develop COVID-19 from infection with B.1.351, and were almost completely protected from severe disease (Abu-Raddad et al., 2021).

The Oxford–AstraZeneca vaccine did not fare as well in another test: in South Africa, a small clinical trial suggested that the vaccine did little to fend off infections of the B.1.351 variant that, by that point, was causing most infections there (Madhi et al., 2021).

As a result, the South African government made the difficult decision to sell its doses and await a different vaccine. It is now rolling out the vaccine produced by Johnson & Johnson in New Brunswick, New Jersey, which in one clinical trial was 64% effective at blocking moderate to severe COVID-19 in South Africa at a time when B.1.351 constituted more than 94% of the infections in the trial (Madhi et al., 2021).

A vaccine made by Novavax in Gaithersburg, Maryland, which has not yet been authorized for emergency use, was 51% effective at preventing symptomatic COVID-19 among participants in South Africa who did not have HIV (Shinde et al., 2021).

There was still hope that it could protect against severe disease and death, a possibility that was not tested in the trial, which enrolled mostly young participants with a low risk of severe disease. Shabir notes that a later study in hamsters (Fischer et al., 2021) found that the vaccine prevented clinical disease caused by B.1.351. The coronavirus COVID-19 has proved to be much more prone to mutations than researchers first thought, and more variants are emerging all the time.

One variant of concern, called B.1.617.2, was first identified in India and is spreading rapidly in the UK, raising worries that it could be unusually transmissible. Public Health England (2021) has determined that two doses of either the Pfizer–BioNTech or the Oxford–AstraZeneca vaccines are 88% and 60% effective, respectively, at preventing symptomatic disease caused by this variant (Bernal et al., 2021b).

In the meantime, some researchers are looking to natural immunity as a guide. A study in more than 25,000 health-care workers in the United Kingdom found that a COVID-19 infection reduced the risk of catching the virus again by 84% for at least 7 months (Hall et al., 2021).

How soon that booster is needed could depend in part on the rate at which antibody levels decline — they could drop precipitously or plateau at a low level. One modelling study (Houry et al., 2021) estimates that low levels of antibodies will be enough to offer significant protection against severe disease.

But Pfizer chief executive Albert Bourla has said that he expects a booster to be needed in about 8–12 months after the second dose of the Pfizer–BioNTech vaccine. Vaccine developers are now testing variant-specific boosters, too.

Moderna has released preliminary results showing that a booster vaccine using a spike-protein sequence from the B.1.351 variant increased the concentration of antibodies that neutralize SARS-CoV-2, and particularly the B.1.351 variant (Wu et al., 2021).

Researchers have been trying to fill this gap, and, so far, the data look promising. Results announced by Johnson & Johnson from clinical trials suggest that its vaccine is 74% effective against asymptomatic infections. Researchers studying deployment of the Pfizer–BioNTech vaccine in Israel have also reported that vaccination reduces the amount of virus found in infected individuals by up to 4.5-fold, suggesting that they could be less likely to shed that virus into the environment, where it might infect someone else (Levine-Tiefenbrun et al., 2021).

A study (Harris et al., 2021) by Public Health England has found that even a single dose of either the Pfizer–BioNTech or Oxford–AstraZeneca vaccine reduced the spread of disease from infected individuals to household members by up to 50%. It's likely that all the vaccines have some similar effect.

Shortly after inoculations with the Pfizer–BioNTech vaccine began, a few regions reported cases of a severe allergic reaction called anaphylaxis. But further study showed that the risk of this condition — which can be treated at the vaccination centre — is not much higher for the Moderna and Pfizer–BioNTech jabs than for other vaccines. For Pfizer–BioNTech, the risk is about 4.7 cases per 1 million doses (Shimabukuro et al., 2021); the risk of anaphylaxis from any vaccination is estimated at 1.3 in a million.

Sputnik V COVID-19 Vaccine Begins in Europe

The European Medicines Agency has begun a rolling review based on laboratory and clinical studies of the Sputnik V (Gam-COVID-Vac). The European Medicines Agency (EMA) announced on March 4, 2021 that its human medicines committee (CHMP) has begun a rolling review of the Sputnik V (Gam-COVID-Vac) COVID-19 vaccine. The review is based on results from laboratory and clinical trial studies that indicate the vaccine triggers the production of antibodies and immune cells. The rolling review will look at data as they become available and will continue until there is enough evidence to support a formal marketing authorization application. The usual standards for effectiveness, safety, and quality will be assessed by the agency for the vaccine, according to EMA.

Sputnik V (Gam-COVID-Vac) was developed by Russia's Gamaleya National Centre of Epidemiology and Microbiology.

EMA states that the vaccine is made up of Ad26 and Ad5 adenoviruses that “have been modified to contain the gene for making the COVID-19 spike protein; they cannot reproduce in the body and do not cause disease. The two adenoviruses are given separately: Ad26 is used in the first dose and Ad5 is used in the second to boost the vaccine's effect.”

WHO approval of Chinese CoronaVac

CoronaVac is one of two Chinese vaccines already sustaining vaccination campaigns in more than 70 nations. Both should soon be much more widely available to low-income countries. The WHO has approved a second Chinese vaccine for emergency use.

CoronaVac was found to be 51% effective at preventing COVID-19 in late-stage trials, and researchers say it will be a key to curbing the pandemic. This overall protection is lower than that provided by the seven other vaccines already listed by the WHO.

But, importantly, trials suggest that CoronaVac is an inactivated-virion vaccine produced by Beijing-based Company Sinovac which is 100% effective at preventing severe disease and death. “CoronaVac will significantly contribute to the global fight against COVID-19 as a safe and moderately effective COVID-19 vaccine.

COMPARISON BETWEEN FOUR COVID VACCINES

Vaccine developer	Pfizer	Moderna	AstraZeneca	Johnson & Johnson
How it works	Messenger RNA	Messenger RNA	Inactivated cold virus	Modified cold virus
What percentage of people did it protect from getting infected in clinical studies?	95%	94.1%	70%	66.1% globally; 72% in the USs.; 86% effective against severe disease
How many shots do you need?	Two doses, 3 weeks apart	Two doses, 4 weeks apart	Two doses, a month apart	One dose
What are the side effects?	Fatigue, headache, chills, muscle pain, especially after the second dose.	Fever, muscle aches, headaches lasting a few days. Effects worse after second dose.	Injection site pain, fever, muscle aches, headache.	Injection site pain, headache, fatigue, muscle pain.
Who is it recommended for?	People 16 years and older	People 18 years and older.	Not yet available.	People 18 years and older.
Is there anyone who shouldn't get the vaccine?	People with a history of allergic reactions to vaccine ingredients including polyethylene glycol, and anyone with a history of allergic reactions to polysorbate	Not yet available.	Anyone who's had a severe allergic reaction to an ingredient in the vaccine.	Is there anyone who shouldn't get the vaccine?
What about people with lowered immune function?	There is limited safety data in this group	Not yet available.	What about people with lowered immune function?	There is limited safety data in this group.

SIDE EFFECTS OF THE SECOND DOSE OF THE VACCINE

It does appear that people have more effects after the second dose than the first. The reason is as the vaccine gets your body ready to fight the disease, some of the things in the human body does to fight the virus makes you feel a little under the weather. That's because the vaccine is like a training program for your immune system. A lot of what your body does immune system, the cells that are stimulated, the antibody production that's underway and all that stuff can make you feel, not so great for a day or 2 days.

Although these side effects can be unpleasant, they are temporary and an indication the vaccine is working. Older people tend to have fewer side effects than people in the 18 to 55 range, possibly because younger people have more active immune systems. Nature News on 06 July 2021 mentioned that **mounting evidence suggests Sputnik COVID vaccine is safe and effective:** Russia's vaccine is in use in more than 70 nations, but its adoption has been slowed by controversies and questions over rare side effects, and it has yet to garner WHO approval.

Russia's COVID-19 vaccine, Sputnik, has been the subject of fascination and controversy since the Russian government authorized its use last year, before early-stage trial results were published. Evidence from Russia and many other countries now suggests it is safe and effective — but questions remain about the quality of surveillance for possible rare side effects.

Sputnik V is also known as Gam-COVID-Vac and was the first COVID-19 vaccine to be registered for use in any nation, and it has since been approved in 67 countries, including Brazil, Hungary, India and the Philippines. But the vaccine (and its one-dose sibling Sputnik Light) has yet to receive approval for emergency use from the European Medicines Agency (EMA) or the WHO. Approval by the WHO is crucial for widespread distribution through the COVID-19 Vaccines Global Access (COVAX) initiative, which is providing doses for lower-income nations.

Some of that concern was allayed when the phase III trial results¹, published in February by the vaccine's developers, suggested that it is 91.6% effective at preventing symptomatic COVID-19 infection and 100% effective at preventing severe infection. However, some scientists criticized the authors for failing to provide access to the full raw data from the early stage trials, and also voiced concerns about changes in the vaccine's administration protocol and inconsistencies in the data.

VACCINES MADE FROM GENETIC MATERIAL CALLED mRNA?

- The Pfizer vaccine uses a snippet of genetic material called messenger RNA that doesn't contain the virus itself, but rather a genetic code associated with the coronavirus that triggers the body's immune response to fight it.
- The mRNA essentially teaches human cells to make something resembling the so-called spike protein found on the surface of the coronavirus.
- This prompts the body's natural defense to destroy it, if the vaccinated person is later exposed to the real virus.
- **The COVID-19 vaccine cannot give someone the virion and cannot affect or interact with our DNA or change our genes in any way.**

WILL COVID BECOME A DISEASE OF THE YOUNG?

A growing share of infections among unvaccinated youths in countries with high vaccination rates is putting the spotlight on the role of young people in the pandemic. The decision came in response to a trend that many countries with high rates of vaccination are experiencing: an ever-increasing proportion of new infections are in younger age groups. In the USs and the UK, COVID-19 has become a disease of the unvaccinated and who are predominantly young. This shift is occurring in many countries that vaccinated older people first, and are now reaching high levels of vaccination in the adult population.

It follows an earlier drop in age resulting from public-health measures to prevent the spread of COVID-19 among older people who are most at risk of severe disease, such as those in nursing homes, say researchers. Magnusson (2021) mentioned that the impact of COVID-19 in children on Norway's health-care system.

Also, she reported that although they didn't need specialist care, children often needed to see their doctor repeatedly for up to six months after contracting the virus. However, the overall risk of severe disease in children remains low, and in many countries that have observed the proportion of cases rising in younger age groups, the total number of cases has fallen, he points out.

And countries also need to consider the global context. Although the downward shift in the average age of infections in countries with high COVID-19 vaccination rates is an interesting phenomenon, it might be short-lived. A few scenarios could shift the balance back. Many countries could start to vaccinate younger people as Israel and the USs are already doing or new variants and waning immunity among older age groups could make them freshly sensitive. COVID-19 could still become a disease of the young. But how big a problem that is, is not a simple thing to respond to (Nature, 2021).

IMPACTS OF COVID-19 ON HEALTHCARE

Which Jobs Are in the Highest Demand in 2021?

The COVID-19 pandemic increased demand for healthcare workers, which was already growing due to the large aging population. The number of healthcare careers is expected to grow more than careers in many other industries over the next decade, adding approximately 2.4 million new jobs by 2029.

While healthcare is a safe field to pursue if you are looking for a stable career, the specific jobs that are in the highest demand will likely fluctuate based on the specific context and needs of the moment. As we begin 2021, here are what appear to be the healthcare jobs in the greatest demand for this year:

- Nurse Practitioner
- Medical Assistant
- Physical Therapist Assistant
- Occupational Therapy Assistant

As the COVID-19 pandemic evolves and more is revealed about gaps in our healthcare services, it will become clearer which healthcare careers may be the most fruitful to pursue in the coming years. Here are 6 healthcare jobs that have proven to be pandemic safe:

1. Medical Lab Technicians
2. Medical Transcriptionists
3. Claims Processors - Medical
4. Copywriters - Medical
5. Healthcare Data Analysts
6. Epidemiologists

So, even in a pandemic that decimates an economy such as COVID-19, there are some jobs that will still be in high demand and are essentially pandemic proof.

CONCLUSIONS AND RECOMMENDATIONS

The severe acute respiratory syndrome COVID-19 pandemic had a significant economic and social impact on the world. Since there is no effective medical treatment for COVID-19 at present, the international collaborative efforts are more focused on developing a safe and effective vaccine against COVID-19. It is recommended that HBM variables predicting a definite intention to take COVID-19 vaccination should be considered in the design of public health interventions to promote COVID-19 vaccination uptake at the community level. This explored various factors influencing the COVID-19 vaccination intention and the applicability of the health belief model to explore vaccination intention among the population of world. Increasing COVID-19 vaccine uptake among a larger section of the population is an important public health priority at the moment as many vaccine candidates approved for use have shown efficacy in preventing COVID-19 infection and associated complications. Vaccination is the most effective method for a long-term strategy for prevention and control of COVID-19 in the future.

Recent emergence and spread of variants have been reported with some concern regarding possible increased transmission and impact on immune responses. There is a real need for more studies regarding the public perception and acceptance of COVID-19 vaccines in the world. Further study should include the impact of COVID vaccine uptake on these rates.

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