Journal of Sciences and Multidisciplinary Research
Volume 12, Number 2, 2020
ISSN: 2277-0135
http://www.cenresinjournals.com

COVID-19: THE NASCENT, SEEMINGLY INVINCIBLE FOE – A REVIEW PAPER

Oduwobi, O. O. & Alagamba, E. A.
Department of Science Laboratory Technology,
Federal Polytechnic, Ilaro, Ogun State.
*E-mail: oludayo.oduwobi@federalpolyilaro.edu.ng

ABSTRACT

Corona virus (responsible for COVID-19 pandemic) which has been referred to as 'the invisible enemy' is currently ravaging the world and her economy; unleashing untold terror among the global citizens, its novelty notwithstanding. The pandemic has put scientists and researchers across the continents on the edge and the race to develop an effective vaccine in combating the scourge is still on. Various clinical studies and trials have been conducted but the pandemic seems to defy a solution. Unfortunately, there is still no effective anti-viral agent to curb the overwhelming menace. However, scientists are emerging with new facts and updating the global citizenry from time to time as to how to beat and manage the pandemic whilst staying alive. The WHO (global health watchdog) and the various CDC have been the people's lifeline during this trying period; monitoring the events surrounding the pandemic by way of surveillance and rendering timely recommendations. COVID-19 is not a death wish but rather a necessary evil, amidst conspiracy theories, to challenge individuals' innate immune systems. Medical personnel have been on the front line, ensuring that the human race is not threatened into extinction in this unusual biological war. The attempt to discover an effective vaccine is still in top gear, with the superpowers covertly in competition with one another in the race to emerge as the first to achieve this feat, in order to redeem the world from this catastrophic and unprecedented quagmire since the infamous Spanish flu.

Keywords: Pandemic, vaccine, novelty, conspiracy theories, unprecedented quagmire

INTRODUCTION

VIRUSES

A virus is a small obligate intracellular parasite that cannot reproduce by itself. Viruses are the smallest of all the microbes. Once it infects a susceptible cell, a virus can direct the cell machinery to produce more viruses. Most viruses have either RNA or DNA as their genetic material. The nucleic acid may be single or double-stranded. The entire infectious viral particle; called a virion, consists of the nucleic acid and an outer shell of protein. Viruses are intracellular parasites that replicate only after infecting specific host cells. Viral infection begins when proteins on the surface of a virion bind to specific receptor proteins on the surface of host cells. The specificity of this interaction determines the host range of a virus (Lodish, Berk, Zipursky, Matsudaira, Baltimore and Darnell, 2000). Viruses only exist to make more viruses. The viral particle attaches to the host's cell before penetrating it. The virus then uses the host's cell's machinery to replicate its own genetic material. Once replication has been completed, the viral particles leave the host by either budding or bursting out of the cell (lysis). DNA viruses tend to replicate

within the nucleus of host's cells, whereas RNA viruses generally do so in the cytoplasm (Wu, 2020).

Viruses can infect all types of life forms, from animals and plants to microorganisms, including bacteria and archaea (Koonin, Senkevich and Dolja, 2006). Viral infections in animals provoke an immune response that usually eliminates the infecting virus. Immune responses can also be produced by vaccines, which confer an artificially acquired immunity to the specific viral infection. Some viruses, including those that cause AIDS, HPV (Human Papilloma Virus) infection and viral hepatitis, evade these immune responses and result in chronic infections. Several antiviral drugs have been developed (Robilotti, Deresinski and Pinsky, 2015). Viruses are found wherever there is life and have probably existed since living cells first evolved (Iyer, Balaji, Koonin and Aravind, 2006). Viruses display a wide diversity of shapes and sizes called morphologies. In general, viruses are much smaller than bacteria. Most viruses cannot be seen with an optical microscope, so scanning and transmission electron microscopes are used to visualise them (Ammerman, Beier-Sexton and Azad, 2008).

The body's first line of defence against viruses is the innate immune system. This comprises cells and other mechanisms that defend the host from infection in a non-specific manner. This means that the cells of the innate system recognise and respond to pathogens in a generic way but unlike the adaptive immune system, it does not confer long-lasting or protective immunity to the host (Alberta, Johnson, Lewis, Raff, Roberts and Walters, 2002). The production of interferon is an important host-defence mechanism. This is a hormone produced by the body when viruses are present. Its role in immunity is complex; it eventually stops the viruses from reproducing by killing the infected cell and its close neighbours (Le Page, Génin, Baines and Hiscott, 2000). Not all viral infections produce a protective immune response e.g. HIV.

Ironically, viruses could be essentially useful! Aside from being the causative agents of many diseases, viruses are important tools in cell biology research, particularly in studies on macromolecular synthesis. Since many viruses can infect a large number of different cell types, genetically modified viruses often are used to carry foreign DNA into a cell. This approach provides the basis for a growing list of experimental gene therapy treatments (natural genetic engineering) (Lodish *et al.*, 2000). Virotherapy involves the use of genetically modified viruses to treat diseases (Jefferson, Cadet and Hielscher, 2015). Viruses have been modified by scientists to reproduce in cancer cells and destroy them but not infect healthy cells.

CORONA VIRUSES

Corona viruses are a large family of viruses that are known to cause illnesses ranging from acute to mild upper respiratory infection (common cold). Transmission is usually via airborne droplets to the nasal mucosa. Virus replicates locally in cells of the ciliated epithelium, causing cell damage and inflammation. Colds caused by corona viruses cannot be distinguished clinically from other colds caused by rhino viruses in any one individual. Laboratory diagnosis may be made on the basis of antibody titers in paired sera (Schmid, Allan and Cooney, 1986). The virus is difficult to isolate but corona viruses can usually be isolated in human embryonic fibroblast cultures. For research purposes, the virus can be cultured from nasal swabs or washings by inoculating organ cultures of human foetal or nasal tracheal epithelium. The viruses in these cultures are detected by electron microscopy or other methods. Nucleic acid hybridization tests (including PCR - polymerase chain reaction) are now being introduced and are the most sensitive assays currently available for detecting viruses. Treatment of common colds is symptomatic; no vaccines or specific drugs are available (Spaan, Cavanagh and Horzinek, 1988). Hygiene measures reduce the rate of transmission.

Corona viruses are found in avian and mammalian species. They resemble each other in morphology and chemical structure; for example, the corona viruses of humans and cattle are antigenically related. Corona viruses invade the respiratory tract via the nose. After an incubation period of about 3 days, they cause the symptoms of a common cold, including nasal obstruction, sneezing, runny nose and occasionally, cough. The disease resolves in a few days, during which virus is shed in nasal secretions. Studies in both organ cultures and human volunteers show that corona viruses are extremely fastidious and grow only in differentiated respiratory epithelial cells (Sanchez, Jimenez and Laviada, 1990). Cell damage triggers the production of inflammatory mediators, which increase nasal secretion and cause local inflammation and swelling. These responses in turn stimulate sneezing, obstruct the airway and raise the temperature of the mucosa.

Immunity does not persist and subjects may be re-infected, sometimes within a year. About one in five colds is due to corona viruses. The virus is usually transmitted via inhalation of contaminated droplets but it may also be transmitted by the hands to the mucosa of the nose or eyes (Gwaltney, 1985).

CORONA VIRUS DISEASE

Corona viruses are a family of viruses that can cause illnesses such as the common cold, severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS). In late 2019, a new corona virus was identified as the cause of a disease outbreak that originated in Wuhan, Hubei, China (Galeotti, 2020). This is a new corona virus that has not been previously identified in humans. This new group of viruses was named corona virus (corona denoting the crown-like appearance of the surface projections) and was later officially accepted as a new genus of viruses (Tyrrell and Bynoe, 1966). It is thought to have an animal (zoonotic) origin. The virus is now known as the severe acute respiratory syndrome corona virus 2 (SARS-CoV-2). The disease it causes is called corona virus disease 2019 (COVID-19). The World Health Organization (WHO) declared the COVID-19 outbreak a public health emergency of international concern (PHEIC) on 30 January 2020 and a pandemic on 11 March 2020 (WHO, 2020). The official names COVID-19 and SARS-CoV-2 were issued by the WHO on 11 February, 2020. WHO chief; Tedros Adhanom Ghebreyesus, explained: CO for corona, VI for virus, D for disease and 19 for when the outbreak was first identified (31 December, 2019).

Signs and symptoms of corona virus disease 2019 (COVID-19) may appear two to 14 days after exposure. The time after exposure and before having symptoms is called the incubation period. Common signs and symptoms can include; fever, cough and tiredness. Other symptoms can include; shortness of breath or difficulty breathing, muscle aches, chills, sore throat, loss of taste or smell, headache, chest pain. This list is not all inclusive. Other less common symptoms have been reported, such as rash, nausea, vomiting and diarrhoea. Children have similar symptoms to adults and generally have mild illness. The standard method of diagnosis is by real-time reverse transcription polymerase chain reaction (rRT-PCR) from a nasopharyngeal swab (CDC, 2020). Results are generally available within a few hours to two days. Blood tests can be used but these require two blood samples taken two weeks apart and the results have little immediate value (Brueck, 2020).

The lungs are the organs most affected by COVID-19 because the virus accesses host cells via the enzyme angiotensin-converting enzyme 2 (ACE2), which is most abundant in type II alveolar cells of the lungs (Verdecchia, Cavallini, Spanevello, Angeli and 2020). Another common cause of death is complications related to the kidneys. Early reports show that up to 30% of hospitalized patients in both China and New York have experienced some injury to their kidneys, including some persons with no previous kidney problems (Wadman, 2020).

The severity of COVID-19 symptoms can range from very mild to severe. Some people may have only a few symptoms and some people may have no symptoms at all. People who are older or who have existing chronic medical conditions, such as heart disease, lung disease, diabetes, severe obesity, chronic kidney or liver disease or who have compromised immune systems may be at higher risk of serious illness. This is similar to what is seen with other respiratory illnesses, such as influenza. Some people may experience worsened symptoms, such as worsened shortness of breath and pneumonia, about a week after symptoms start. The virus appears to spread easily among people and more continues to be discovered over time about how it spreads. Data has shown that it spreads from person to person among those in close contact (within about 6 feet or 2 meters). The virus spreads by respiratory droplets released when someone with the virus coughs, sneezes or talks. These droplets can be inhaled or land in the mouth or nose of a person nearby. Sputum and saliva carry large amounts of virus (To, Tsang, Chik-Yan Yip, Chan, Wu and Chan, 2020).

Children make up a small proportion of reported cases; with about 1% of cases being children less than 10 years and 4% aged 10–19 years (Dong, Mo, Hu, Qi, Jiang, Jiang and Tong, 2020). They are likely to have milder symptoms and a lower chance of severe disease than adults. In those younger than 50 years, the risk of death is less than 0.5% while in those older than 70, it is more than 8%. Pregnant women may be at higher risk of severe COVID-19 infection based on data from other similar viruses, like severe acute respiratory syndrome (SARS) and Middle East respiratory syndrome (MERS) but data for COVID-19 is lacking (Fang, Karakiulakis and Roth, 2020). According to scientific reviews smokers are more likely to require intensive care or die compared to non-smokers, air pollution is similarly associated with risk factors and obesity contributes to an increased health risk of COVID-19 (Tamara, Tahapary and Dicky, 2020). It can also spread if a person touches a surface with the virus on it and then touches his or her mouth, nose or eyes, although this isn't considered to be the main way it spreads. Risk factors for COVID-19 appear to include; recent travel from or residence in an area with on-going community spread of COVID-19 as determined by CDC (Centres for Disease Control) or WHO and close contact (within 6 feet or 2 meters) with someone who has COVID-19 for more than 5 minutes or being coughed or sneezed on by an infected person.

The field of corona virology has advanced significantly in recent years. The SARS epidemic was a dramatic reminder that animal corona viruses are potential threats to the human population, although the exact mechanism of species-to-species spread of the SARS corona virus remains obscure (Kahn and McIntosh, 2005).

INFLUENZA VIRUSES' SHARED SIMILARITIES WITH CORONA VIRUSES

In virus classification, influenza viruses are RNA viruses that make up four of the seven genera of the family Orthomyxoviridae. Influenza, commonly known as "the flu", is an infectious disease caused by an influenza virus (Kawaoka, 2006). Symptoms can be mild to severe. These symptoms typically begin two days after exposure to the virus and most last less than a week (CDC, 2014). When an infected person sneezes or coughs, more than half a million viral particles can be spread to those that are close by. Influenza can be spread in three main ways; by direct transmission (when an infected person sneezes mucus directly into the eyes, nose or mouth of another person); the airborne route (when someone inhales the aerosols produced by an infected person coughing, sneezing or spitting) and through hand-to-eye, hand-to-nose or hand-to-mouth transmission, either from contaminated surfaces or from direct personal contact such as a handshake (Sherman, 2007). Although, a single sneeze releases up to 40,000 droplets, most of these droplets are quite large and will quickly settle out of the air. How long influenza survives in airborne droplets seems to be influenced by the levels of humidity and UV radiation, with low humidity and a lack of sunlight in winter aiding its survival (Hall, 2007). A vaccine made for one year may not be useful in the following year, since the virus evolves rapidly.

In the 20th century, three influenza pandemics occurred; Spanish influenza in 1918 (17–100 million deaths), Asian influenza in 1957 (two million deaths) and Hong Kong influenza in 1968 (one million deaths) (Spreeuwenberg, Kroneman and Paget, 2018). The World Health Organization declared an outbreak of a new type of influenza A/H1N1 to be a pandemic in June 2009 (Chan, 2009).

There are four types of influenza viruses; A, B, C and D. Human influenza A and B viruses cause seasonal epidemics of disease (known as the flu season). Influenza A viruses are the only influenza viruses known to cause flu pandemics i.e. global epidemics of flu disease. A pandemic can occur when a new and very different influenza A virus emerges that both infects people and has the ability to spread efficiently between people. Influenza type C infections generally cause mild illness and are not thought to cause human flu epidemics. Influenza D viruses primarily affect cattle and are not known to infect or cause illness in people (NCIRD, 2019).

The influenza A (H1N1) virus that emerged in 2009 caused the first global influenza pandemic in more than 40 years (NCIRD, 2019). It was responsible for the Swine Flu outbreak pandemic. Seasonal flu vaccines do not protect against influenza C or D viruses.

In addition, flu vaccines will not protect against infection and illness caused by other viruses that also can cause influenza-like symptoms. There are many other viruses besides influenza that can result in influenza-like illness (ILI) that spread during flu season (NCIRD, 2019). The last pandemic flu the world encountered; the swine flu outbreak of 2009 was less deadly than initially feared, largely because many older people had some immunity to it, probably because of its similarity to other flu viruses that had circulated years before. That virus was called A/H1N1pdm09 (NCIRD, 2019). The CDC follows an internationally accepted naming convention for influenza viruses. The name starts with the virus type, followed by the place the virus was isolated, followed by the virus strain number, the year isolated and finally, the virus subtype.

In theory, a flu pandemic could occur at any time but they are still rare events. Pandemics happen if a new strain emerges that can easily spread from person to person. As it is new, people could have little or no immunity to the virus. Prof James Wood, head of the Department of Veterinary Medicine at the University of Cambridge said, "The work comes as a salutary reminder" that we are constantly at risk of new emergence of pathogens and that farmed animals, with which humans have greater contact than with wildlife, may act as the source for important pandemic viruses" (RobertsHealth, 2020). Although, flu viruses are constantly changing, which is why the flu vaccine also needs to change regularly to keep up, they do not usually cause pandemic.

THE MENACE OF SOME DEADLY VIRUSES

Humans have been battling viruses since before our species had even evolved into its modern form. For some viral diseases, vaccines and antiviral drugs have allowed us to keep infections from spreading widely and have helped sick people recover. For one disease; smallpox, we've been able to eradicate it, ridding the world of new cases. But we're a long way from winning the fight against viruses. In recent decades, several viruses have jumped from animals to humans and triggered sizable outbreaks, claiming thousands of lives. The viral strain that drove the 2014-2016 Ebola outbreaks in West Africa killed up to 90% of the people it infected, making it the most lethal member of the Ebola family. There are other viruses out there that are equally deadly and some that are even deadlier. Some viruses, including the novel corona virus currently driving outbreaks around the globe, have lower fatality rates but still pose a serious threat to public health (Harding, 2020).

The following viruses are considered very deadly, in no particular order, because of their high mortality rates; Marburg virus (mortality rate in the first outbreak was 25%), Ebola virus (rare but fatality rate is up to 50%), Rabies, HIV, Smallpox, Hantavirus, Influenza,

Dengue (at 2.5%), Rotavirus, Hepatitis virus, MERS (mortality rate as high as 37.2%), SARS-CoV (estimated mortality rate of 9.6%,) and SARS-CoV-2 (estimated mortality rate of about 2.3%). Of the aforementioned deadly viruses, hepatitis virus, ebola virus, MERS virus, Influenza virus and HIV are more deadly than the novel corona virus, according to Murphy (2020).

A March 11, 2020 article in the Washington Post reports that some epidemiology experts think the corona virus disease outbreak will be close in scale to an influenza pandemic in 1957 that caused more than 1 million deaths worldwide, including 70,000 in the U.S. and made a quarter-billion people sick. However, these experts do not believe it will be as devastating as the Spanish flu of 1917-1918, which killed an estimated 50 million people, infected one-third of the global population and was "the deadliest pandemic flu virus in human history," according to the U.S. Centers for Disease Control and Prevention (Levine, 2020). The worst pathogen in human history, however, is by far influenza virus. The main reason; this virus mutates every year, making it virtually impossible to fully defend against. The flu's total death toll rises annually. Plant viruses cannot infect humans and other animals because they can reproduce only in living plant cells (Chen, Zhao, Hammond, Hsu, Evans and Feldlaufer, 2004).

CONTROL OF VIRAL INFECTIONS

Because viruses use vital metabolic pathways within hosts' cells to replicate, they are difficult to eliminate without using drugs that cause toxic effects to hosts' cells in general. The most effective medical approaches to viral diseases are vaccinations; to provide immunity to infection and antiviral drugs that selectively interfere with viral replication.

Vaccination is a cheap and effective way of preventing infections by viruses. Vaccines can consist of live-attenuated or killed viruses or viral proteins (antigens) (Palese, 2006). Live vaccines contain weakened forms of the virus, which do not cause the disease but nonetheless, confer immunity. Such viruses are called attenuated. Live vaccines can be dangerous when given to people with a weak immunity (who are described as immuno-compromised) because in these people, the weakened virus can cause the original disease (Thomssen, 1975). Biotechnology and genetic engineering techniques are used to produce subunit vaccines. These vaccines use only the capsid proteins of the virus. Hepatitis B vaccine is an example of this type of vaccine. Subunit vaccines are safe for immuno-compromised patients because they cannot cause the disease (Casswall and Fischler, 2005).

Antiviral drugs are often nucleoside analogues (fake DNA building-blocks), which viruses mistakenly incorporate into their genomes during replication. The life-cycle of the virus is then halted because the newly synthesised DNA is inactive (Magden, Kääriäinen and Ahola, 2005). Only about one-third to one-half of infected individuals develops symptoms to corona virus infection, however, interferon can protect against infection but its importance is not known. Because corona virus infections are common, many individuals have specific antibodies in their nasal secretions and these antibodies can protect against infection. Most of these antibodies are directed against the surface projections and neutralize the infectivity of the virus. Cell-mediated immunity and allergy have been little studied but may play a role (Tyrell, Cohen and Schlarb, 1993). Although, antiviral therapy has been attempted, the treatment of corona virus colds remains symptomatic. The likelihood of transmission can be reduced by practising hygienic measures. Vaccines are not currently available (Myint, Johnstone, Sanderson and Simpson, 1994). There are no vaccines or specific antiviral treatments for COVID-19. Management involves the treatment of symptoms, supportive care, isolation and experimental measures. Outside the human body, the virus is killed by household soap, which bursts its protective bubble (Cliff and Smallman-Raynor, 2013).

Three vaccination strategies are being investigated. First, researchers aim to build a whole virus vaccine. The use of such a virus, be it inactive or dead, aims to elicit a prompt immune response of the human body to a new infection with COVID-19. A second strategy, subunit vaccines, aims to create a vaccine that sensitises the immune system to certain subunits of the virus (Caswall and Fischler, 2005). In the case of SARS-CoV-2, such research focuses on the S-spike protein that helps the virus intrude the ACE2 enzyme receptor. A third strategy is that of the nucleic acid vaccines (DNA or RNA vaccines, a novel technique for creating a vaccination). The World Health Organization suspended hydroxychloroquine from its global drug trials for COVID-19 treatments on 26 May 2020 due to safety concerns (WHO, 2020).

VACCINATION

Vaccination is the administration of a vaccine to help the immune system develop protection from a disease. Vaccines contain a microorganism or virus in a weakened, live or killed state or proteins or toxins from the organism. In stimulating the body's adaptive immunity, they help prevent sickness from an infectious disease. When a sufficiently large percentage of a population has been vaccinated, herd immunity results. Vaccination is the most effective method of preventing infectious diseases (Gellin, 201).

Widespread immunity due to vaccination is largely responsible for the worldwide eradication of smallpox and the elimination of diseases such as polio and tetanus from much of the world. Vaccination and immunization have a similar meaning in everyday language.

The body's immune system helps protect against pathogens that cause infection. Most of the time, it's an efficient system. It either keeps microorganisms out or tracks them down and gets rid of them. However, some pathogens can overwhelm the immune system. When this happens, it can cause serious illnesses. The pathogens most likely to cause problems are the ones the body doesn't recognize. Vaccination is a way to "teach" the immune system how to recognize and eliminate an organism. That way, the body is prepared if one is ever exposed (McNeil, 2019). When the body responds to the vaccine, it builds an adaptive immune response. This helps equip the body to fight off an actual infection.

Vaccines are usually given by injection. Most vaccines contain two parts. The first is the antigen. This is the piece of the disease the body must learn to recognize. The second is the adjuvant. The adjuvant sends a danger signal to the body. It helps the immune system to respond more strongly against the antigen as an infection. This helps one develop immunity. Vaccines are considered to be safe. They're rigorously tested and go through many rounds of study, examination and research before they're used on the general public. Vaccines are highly effective but no vaccine is 100 percent effective. The effectiveness rate for vaccines differs from one type to the next (Gellin, 2016).

Antibodies help the body recognize antigens of diseases. Protection from antibodies can be achieved in two different ways. Active immunization is the immunity the body achieves when it's triggered to produce its own antibodies against antigens of a disease you're exposed to. It stimulates long-term protection against a disease. Active immunity can occur after an infection (natural/innate immunity). It can also occur through vaccination (artificial/adaptive immunity). Passive immunization provides short-term protection against a disease. It occurs when someone receives antibodies instead of making their own. Passive immunity is transmitted naturally from mother to child during birth and breastfeeding. It can also be achieved artificially through the injection of immune globulins. These are antibody-containing blood products (Boulanger, 2019).

Everyone's immune system is different but as a general rule, it becomes stronger during adulthood, as by this time, one must have been exposed to more pathogens and developed

more immunity. That is why teens and adults tend to get sick less often than children. Once an antibody has been produced, a copy remains in the body so that if the same antigen appears again, it can be dealt with more quickly. That is why with some diseases, such as chickenpox, one can only get it once as the body has a chickenpox antibody stored, ready and waiting to destroy it next time it arrives. This is called immunity.

HERD IMMUNITY

Herd immunity is a form of indirect protection from infectious disease that occurs when a large percentage of a population has become immune to an infection, whether through vaccination or previous infections, thereby providing a measure of protection for individuals who are not immune. In a population in which a large proportion of individuals possess immunity, such people being unlikely to contribute to disease transmission, chains of infection are more likely to be disrupted, which either stops or slows the spread of disease (Fiore, Bridges and Cox, 2009). The greater the proportion of immune individuals in a community, the smaller the probability that non-immune individuals will come into contact with an infectious individual, helping to shield non-immune individuals from infection.

If herd immunity has been established and maintained in a population for a sufficient time, the disease is inevitably eliminated — no more endemic transmissions occur (Lombard, Pastoret and Moulin, 2007). If elimination is achieved worldwide and the number of cases is permanently reduced to zero, then a disease can be declared eradicated. Eradication can thus be considered the final effect or end-result of public health initiatives to control the spread of infectious disease. To date, two diseases have been eradicated using herd immunity and vaccination: rinderpest and smallpox (Fiore et al., 2009). Vaccinations are the safest way to practice herd immunity in a population.

FACTS AND MYTHS OF COVID-19

The novel corona virus, now known as SARS-CoV-2, has spread from Wuhan, China, to every continent on Earth except Antarctica. As ever, when the word "pandemic" starts appearing in the headlines, people become fearful and with fear, come misinformation and rumors (WHO, 2020).

COVID-19 FACTS

- People should not wear masks when exercising, as masks may reduce the ability to breathe comfortably.
- The likelihood of shoes spreading COVID-19 is very low.

- The corona virus disease (COVID-19) is caused by a virus, not by a bacterium.
- The prolonged use of medical masks when properly worn does not cause CO_2 intoxication or oxygen deficiency.
- Most people who get COVID-19 recover from it.
- Drinking alcohol does not protect against COVID-19 and can be dangerous.
- Thermal scanners/infra-red thermometres cannot detect COVID-19.
- There are currently no drugs licensed for the treatment or prevention of COVID-19.
- Adding pepper to your soup or other meals does not prevent or cure COVID-19.
- COVID-19 is not transmitted through houseflies or mosquitoes.
- Spraying and introducing bleach or another disinfectant into the body will not protect against COVID-19 and can be dangerous.
- Drinking methanol, ethanol, sanitizers or bleach does not prevent or cure COVID-19 and can be extremely dangerous.
- 5G mobile networks do not spread COVID-19.
- Exposing oneself to the sun or temperatures higher than 25°C does not protect one from COVID-19.
- Catching COVID-19 does not mean one will have it for life.
- Being able to hold one's breath for 10 seconds or more without coughing or feeling discomfort does not mean that one is free from COVID-19.
- The COVID-19 virus can spread in hot and humid climates.
- Cold weather and snow cannot kill the COVID-19 virus.
- Taking a hot bath does not prevent COVID-19.
- Hand dryers are not effective in killing the COVID-19 virus.
- Ultra-violet (UV) lamps should not be used to disinfect hands or other areas of the skin.
- Vaccines against pneumonia do not protect against the COVID-19 virus.
- Rinsing the nose with saline, gargling bleach or eating garlic does not prevent COVID-19.
- People of all ages can be infected by the COVID-19 virus.

COVID-19 MYTHS

Most of the myths surrounding COVID-19 stemmed out from internet rumors;

- You can get a face mask exemption card so you don't need to wear a mask.
- You can protect yourself from COVID-19 by injecting, swallowing, bathing in or rubbing onto your body bleach, disinfectants or rubbing alcohols.
- A vaccine to cure COVID-19 is available.
- Ordering or buying products shipped from overseas will make a person sick.

- Spraying chlorine or alcohol on the skin kills viruses in the body.
- Only older adults and young people are at risk, children cannot get COVID-19.
- COVID-19 is just like the flu.
- Everyone with COVID-19 dies.
- Face masks always protect against corona virus.
- You have to be with someone for 10 minutes to catch the virus.
- Home remedies can cure and protect against COVID-19.
- You can catch corona virus from eating Chinese food or using imported Chinese products.
- The new corona virus was deliberately created or released by people.
- The virus originated in a laboratory in China and it is not a natural product of evolution.
- 5G helps SARS-CoV-2 spread and originated from Wuhan as Wuhan was one of the first cities to try 5G in China.

GLOBAL STATISTICS ON COVID-19

According to World meter's COVID-19 data published in July 23, 2020, the report on COVID-19 revealed that the number of global COVID-19 confirmed cases stood at 15, 398, 312, the number of global deaths is 630, 748 and the number of global recoveries is 9, 372, 972 (WHO, 2020). At the early stage of the pandemic, China had the highest number of dead individuals to COVID-19, being the genesis of fatalities to COVID-19. This was shortly surpassed by Italy, followed by Spain and the U.S., with Italy recording the highest number. They were the first three countries to cross the COVID-19 10, 000 fatality mark. Currently, the U.S. tops the global statistics with an overwhelming number of 146,192 deaths. This is followed by Brazil (82,890), UK (45,501), Mexico (41,190) and France (30,172) as the five countries with the highest cases in a descending order. The first and probably the only country to record a single 1,000+ fatalities in a single day is U.S.A.

From a public health point of view, COVID-19 just like flu epidemics spread rapidly and is very difficult to control. Its generation time is short: the time from a person becoming infected to when he or she infects the next person. Another problem is that individuals become infectious before they become symptomatic, which means that putting people in quarantine after they become ill is not an effective public health intervention (Ferguson, Cummings, Cauchemez, Fraser, Riley and Meeyai, 2005).

CONSPIRACY THEORIES ON COVID-19

The COVID-19 pandemic has sparked a lot of conspiracy theories about the origin of the virus, from the one claiming it escaped from a laboratory in Wuhan, to Bill Gates having orchestrated the outbreak as part of an obscure plan to control the world, to exposure to 5G cell phone technology causing the infection. Misinformation and conspiracy theories about COVID-19 continue to flourish in the wake of the pandemic. The psychological research to date suggests that people are attracted to conspiracy theories when important psychological needs are unsatisfied (Douglas, Uscinski, Sutton, Cichocka, Nefes, Ang and Deravi, 2019). All of these needs are likely to be heightened in times of crisis, such as the COVID-19 pandemic. Recent cases of violence have also been linked to COVID-19 conspiracy theories. For example, one conspiracy theory argues that COVID-19 was designed in a Chinese laboratory as a bio-weapon against the West. The sheer coincidence of China's lead institute studying bat corona viruses being in the same city as the origin of the COVID outbreak has proven too juicy for conspiracists to resist. There have since been reports of racial attacks on people of East Asian appearance. Another conspiracy theory argues that 5G technology caused COVID-19 (Fildes, Nic, Di Stefano, Mark, Murphy and Hannah, 2020). On the back of this conspiracy theory, there have been multiple attacks on engineers installing 5G masts. Conspiracy theories have significant consequences.

Bill Gates became a new target of disinformation after gently criticizing the defunding of the World Health Organization. A recent variant of this conspiracy theory, particularly beloved by anti-vaccination activists, is the idea that COVID-19 is part of a dastardly Gates-led plot to vaccinate the world's population. Some have spread the myth that Gates wants to use a vaccination program to implant digital microchips that will somehow track and control people (Shmerling, 2020).

According to Pew Research Centre survey conducted in 2020, nearly three in ten Americans believe that COVID-19 was made in a lab, either intentionally or accidentally. The Chinese government responded to the anti-China theories with a conspiracy theory of its own that seeks to turn blame back around onto the United States. According to Voice of America news, "echoed a rumored conspiracy, widely circulated in China, that US military personnel had brought the virus to China during their participation in the 2019 Military World Games in Wuhan last October" (Budryk, 2020)..Genetically modified crops have been a target of conspiracy theorists for years, so it was hardly a surprise to see GMCs blamed in the early stages of the COVID pandemic (McCarthy, 2020). According to professional conspiracy theorists like David Icke and Info Wars' Alex Jones, COVID-19 doesn't actually exist but is a plot by the globalist elites to take away our freedom. Another far-right meme is the idea that COVID-19 death rates are being inflated and

therefore there is no reason to observe lockdown regulations or other social distancing measures. The World Health Organization has declared an "infodemic" of incorrect information about the virus, which poses risks to global health (Lytvynenko, 2020).

The ability of viruses to cause devastating epidemics in human societies has led to the concern that viruses could be weaponries for biological warfare. Further concern was raised by the successful recreation of the infamous 1918 influenza virus in a laboratory. Smallpox virus devastated numerous societies throughout history before its eradication. It may be used as a weapon (Artenstein and Grabenstein, 2008). The corona virus is thought to be natural and has an animal origin, through spillover infection. The first known human infections were in China. Official publications from the WHO reported the earliest onset of symptoms as 8 December 2019 (Kuo, 2020). Human-to-human transmission was confirmed by the WHO and Chinese authorities by 20 January 2020. According to official Chinese sources, these were mostly linked to the Huanan Seafood Wholesale Market, which also sold live animals.

COVID-19 & 5G TELEPHONY

In telecommunications, 5G is the fifth generation technology standard for cellular networks, which cellular phone companies began deploying worldwide in 2019, the planned successor to the 4G networks which provide connectivity to most current cell phones (de Looper, 2020). 5G wireless is an umbrella term to describe a set of standards and technologies for a radically faster wireless internet that ideally is up to 20 times faster, with 120 times less latency than 4G. The first commercial 5G network was rolled out in Qatar in May 2018. The first major 5G phone to be announced is the Samsung Galaxy S10 5G and was released in April, 2019! 5G is still a cellular broadband technology and is a network of networks. 5G for consumers means not just faster mobile internet but mainly internet connectivity in many more objects than what one can see today (Bowler, 2020). The perception of speed, instantaneous response time and performance for IoT (Internet of Things) will become a reality thanks to 5G. As an example, the well-expected success of self-driving cars will only be possible when 5G networks are available.

The scientific consensus is that 5G technology is safe and arguments to the contrary are based on a conspiratorial red herring that cites the newness of the technology as a reason not to trust it (Hern, 2020). Misunderstanding of 5G technology has given rise to conspiracy theories claiming it has an adverse effect on human health. During the COVID-19 pandemic, several conspiracy theories circulating online posited a link between severe acute respiratory syndrome corona virus 2 (SARS-CoV-2) and 5G. This has

led to dozens of arson attacks being made on telecom masts in the Netherlands (Amsterdam, Rotterdam etc.), Ireland (Belfast, Cork etc.), Cyprus, Scotland, Wales, England (Dagenham, Huddersfield, Birmingham and Liverpool), Belgium (Pelt), Italy (Maddaloni), Croatia (Bibinje) and Sweden. It led to at least 61 suspected arson attacks against telephone masts in the United Kingdom alone and over twenty in the Netherlands (Warren 2020).

THE AFTERMATH OF COVID-19

Along with potentially coping with cardiac, pulmonary and other physical effects, psychologists report that COVID-19 patients may have to sort through cognitive changes, such as difficulties with attention and memory, as well as mental health symptoms for months to come. Some difficulties, such as post-traumatic stress disorder, may be rooted in their experiences with hospital care and intensive care treatments. Psychologists fear that other challenges, such as survivor guilt, may flare once patients are discharged into a world still reeling from the virus. Intensive care unit patients already face a higher risk of delirium, with 20% to 40% of critically ill patients overall developing it and as many as 80% of those who required a mechanical ventilator, according to a review of delirium research (Pandharipande, 2017).

Patients with COVID-19 who developed acute respiratory distress syndrome (ARDS) could have a greater risk of long-term health issues e.g. permanent lung damage or fibrosis as well. Pulmonary fibrosis is a lung disease that occurs when lung tissue becomes damaged and scarred. This thickened, stiff tissue makes it more difficult for the lungs to work properly. As pulmonary fibrosis worsens, one becomes progressively more short of breath. Signs and symptoms of pulmonary fibrosis may include; shortness of breath (dyspnea), a dry cough, fatigue, unexplained weight loss, aching muscles and joints, widening and rounding of the tips of the fingers or toes (clubbing).

Factors that make one more susceptible to pulmonary fibrosis include; age (more likely to affect middle-aged and older adults), sex (more likely to affect men than women), smoking, certain occupations (e.g. mining, farming or construction), cancer treatments (radiation and certain chemotherapy drugs), genetic factors. Impaired lung function from SARS-CoV-2 infection can negatively affect other organs like the heart, kidneys and brain, with significant health impacts that may last after getting over the infection. Not everyone who beats COVID-19 has the same risk of experiencing long-term consequences from the SARS-CoV-2 infection. Those most at risk are "people 65 years and older, people who live

in a nursing home or long-term care facility, people with chronic lung, heart, kidney and liver disease," said Dr. Gary Weinstein (Citroner, 2020).

IMMUNE BOOSTERS

The immune system is precisely that — a system, not a single entity. To function well, it requires balance and harmony.

The immune system can be boosted by adhering to the following; don't smoke, eat diets containing Vit. A (beta carotene), Vit. C, Vit. E, zinc, proteins, fruits and vegetables e.g. citrus fruits (grapefruit, oranges, tangerines, lemons, limes), anti-oxidants, red bell peppers, broccoli, garlic, ginger, spinach, yogurt, almonds, sunflower seeds, turmeric, green tea, papaya, kiwi, poultry, shellfish, exercise regularly, maintain a healthy weight, drink only in moderation, get adequate sleep, take steps to avoid infection, try to minimize stress, stay hydrated (Kubala, 2020).

CONCLUSION

The review paper was necessitated on the premise of the dearth of sufficiently simplified knowledge of COVID-19, particularly among laymen. Covid-19; a novel and frightening phenomenon, is a worrisome pandemic that has come to stay and we are faced with the stark reality of accepting, managing and living with it as the next world's deadliest virus but just like every stronghold has a vulnerable point; an Achilles' heel, the efficacious key to controlling the COVID-19 scourge is by vaccination and effectual breaking of its chain of transmission.

RECCOMMENDATIONS

WHO and CDC recommend following these precautions for avoiding COVID-19;

- Avoid large events and mass gatherings.
- Avoid close contact (within about 6 feet or 2 meters) with anyone who is sick or has symptoms.
- Stay home as much as possible and keep distance between yourself and others. Keep in mind some people may have COVID-19 and spread it to others, even if they don't have symptoms or don't know they have COVID-19.
- Wash your hands often with soap and water for at least 20 seconds or use an alcohol-based hand sanitizer that contains at least 60% alcohol.
- Cover your face with a cloth face mask in public spaces, such as the grocery store, where it's difficult to avoid close contact with others, especially if you're in an area

with ongoing community spread. Only use non-medical cloth masks — surgical masks and N95 respirators should be reserved for health care providers.

- Cover your mouth and nose with your flexed elbow (respiratory etiquette) or a tissue when you cough or sneeze. Throw away the used tissue. Wash your hands right away.
- Avoid touching your eyes, nose and mouth.
- Avoid sharing dishes, glasses, towels, bedding and other household items if you're sick.
- Clean and disinfect high-touch surfaces, such as doorknobs, light switches, electronics and counters, daily.
- Stay home from work, school and public areas if you're sick, unless you're going to get medical care.
- Avoid public transportation, taxis and ride-sharing if you're sick.

Health officials have stated that medical grade facemasks such as N95 masks should be reserved and prioritized for healthcare workers and first responders.

When wearing a mask, it is essential to continue with other precautions, such as not touching the face and practicing physical distancing. You should not take any action without or before consulting with a healthcare professional (WHO, 2020).

To minimize the harm from misinformation, medical professionals and the public are advised to expect rapid changes to available information and to be attentive to retractions and other updates.

Social distancing strategies used during past pandemics, such as quarantines, travel restrictions and the closing of schools, churches and theaters, have been employed to slow the spread of influenza viruses. Researchers have estimated that such interventions during the 1918 Spanish flu pandemic in the US reduced the peak death rate by up to 50% and the overall mortality by about 10–30%, in areas where multiple interventions were implemented (Bootsma and Ferguson, 2007). School closures have been found by most empirical studies to reduce community spread but some findings have been contradictory. Recommendations for these community restrictions are usually on a case-by-case basis.

The risk of zoonotic diseases—infections transmitted from animals to humans, is increasing as we muscle in on the wild. The more we raze habitat for farmland and cities, hunt and trade wildlife, vacation in remote forests and hike through once-inaccessible caves, the greater the chances of "spillover," as scientists call it; when a virus vaults from a species it doesn't harm into one it does, such as ours (Piot, 2020). The corona virus pandemic, suspected of originating in bats and pangolins, has brought the risk of viruses

that jump from wildlife to humans into stark focus. These leaps often happen at the edges of the world's tropical forests, where deforestation is increasingly bringing people into contact with animals' natural habitats. Yellow fever, malaria, Venezuelan equine encephalitis, Ebola – all of these pathogens have spilled over from one species to another at the margins of forests (Levine, 2020).

REFERENCES

Alberts, B., Johnson, A., Lewis, J., Raff, M., Roberts, K. and Walters, P. (2002). *Molecular Biology of the Cell*. (Fourth ed.). New York and London: Garland Science. ISBN 0-8153-3218-1.

Ammerman, N. C., Beier-Sexton, M. and Azad, A. F. (2008). Laboratory maintenance of *Rickettsia rickettsii*. *Current Protocols in Microbiology*. 11 (1): 3A.5.1–3A.5.21. doi:10.1002/9780471729259. mc03a05s11. ISBN 978-0471729259. PMC 2725428. PMID 19016440.

Artenstein, A. W. and Grabenstein, J. D. (2008). Smallpox vaccines for bio-defense: need and feasibility. *Expert Review of Vaccines*. 7 (8): 1225–37. doi:10.1586/14760584.7.8.1225. PMID 18844596

Bootsma, M. C. and Ferguson, N. M. (2007). The effect of public health measures on the 1918 influenza pandemic in U.S. cities. *Proceedings of the National Academy of Sciences of the United States of America*. 104 (18): 7588–93. Bibcode:2007PNAS..104.7588B. doi:10.1073/pnas.0611071104. PMC 1849868. PMID 17416677.

Boulanger, A. (2019). Everything You Need to Know About Vaccinations. Research, Center for Biologics Evaluation, Vaccine Safety & Availability - *Thimerosal and Vaccines*. www.fda.gov. Retrieved 22 March 2019.

Bowler, J. (2020). What's 5G, and Why are People so Scared of it? Here's What You Need to Know. *Science Alert*. Retrieved June 7, 2020.

Brueck, H. (2020). 14 bogus claims about the corona virus, including a fake coconut-oil cure and a false link to imported packages. *Business Insider*. Archived from the original on 6 February 2020. Retrieved 7 March 2020.

Budryk, Z. (2020). Chinese ambassador on Cotton corona virus comments; It's very harmful to stir up unsubstantiated rumors. *The Hill*. Archived from the original on 10 February 2020. Retrieved 11 February 2020.

Casswall, T. H. and Fischler, B. (2005). Vaccination of the immune-compromised child. *Expert Review of Vaccines*. 4 (5): 725–38. doi:10.1586/14760584.4.5.725. PMID 16221073.

Centers for Disease Control and Prevention (CDC) (2014). Archived from the original on 2 December 2014. Retrieved 26 November 2014.

Centers for Disease Control and Prevention (CDC) (2020). CDC Confirms Person-to-Person Spread of New Corona Virus in the United States – CDC Press Release, Jan. 30. 2020.

Centers for Disease Control and Prevention, U.S. (CDC). (2020). Symptoms of Corona virus. Archived from the original on 17 June 2020. Retrieved 18 June2020.

Chan, M. (2009). World now at the start of 2009 influenza pandemic. World Health Organization (WHO). Archived from the original on 12 June 2009. Retrieved 12 June 2009.

Chen, Y., Zhao, Y., Hammond, J., Hsu, H. T., Evans, J. and Feldlaufer, M. (2004). Multiple virus infections in the honey bee and genome divergence of honey bee viruses. Journal of Invertebrate Pathology. 87 (2–3): 84–93. doi:10.1016/j.jip.2004.07.005. PMID 15579317

Citroner, G. (2020). What We Know About the Long-Term Effects of COVID-19 — Fact checked by Michael Crescione. Health news. COVID-19; Latest updates and resources.

Cliff, A. and Smallman-Raynor, M. (2013). Oxford Textbook of Infectious Disease Control: A Geographical Analysis from Medieval Quarantine to Global Eradication. Oxford University Press. pp. 125–36. ISBN 978-01995966l4. Retrieved 29 March 2015.

de Looper, C. (2020). What is 5G? The next-generation network explained. Digital Trends. Retrieved April 25, 2020.

Dong, X., Chen, N., Zhou, M., Qu, J., Gong, F. and Han, Y. (2020). Epidemiological and clinical characteristics of 99 cases of 2019 novel corona virus pneumonia in Wuhan, China: A descriptive study. Lancet. 395 (10223): 507–513. doi:10.1016/S0140-6736(20)30211-7. PMC 7135076. PMID 32007143.

Douglas, K. M., Uscinski, J., Sutton, R. M., Cichocka, A., Nefes, T., Ang, J. and Deravi, F. (2019). Understanding conspiracy theories. Advances in Political Psychology. 40 (S1), 3-35. https://doi.org/10.1111/pops.12568

Fang, Y. Y., Liu, K., Deng, Y., Liu, W., Wang, M. F. and Ma, J. P. (2020). Clinical characteristics of novel corona virus cases in tertiary hospitals in Hubei Province. Chinese Medical Journal. 133 (9): 1025–1031. doi:10.1097/CM9.0000000000000744. PMC 7147277. PMID 32044814.

Ferguson, N. M., Cummings, D. A., Cauchemez, S., Fraser, C., Riley, S. and Meeyai, A. (2005). Strategies for containing an emerging influenza pandemic in Southeast Asia. Nature. 437 (7056): 209

Fildes, N., Di Stefano, M. and Murphy, H. (2020). How a 5G corona virus conspiracy spread across Europe. *Financial Times*. Retrieved April 16, 2020.

Fiore, A. E, Bridges, C. B. and Cox, N. J. (2009). Seasonal influenza vaccines. *Current Topics in Microbiology and Immunology*. **333**. pp. 43–82. doi:10.1007/978-3-540-92165-3_3. ISBN 978-3-540-92164-6. PMID 19768400.

Galeotti, M. (2020). Corona virus Propaganda a Problem for the Kremlin, Not a Ploy. *The Moscow Times*.

Gellin, B. (2016). Vaccines and Infectious Diseases: Putting Risk into Perspective. Archived 13 September 2016 at the Wayback Machine. (Remarks at AMA Briefing on Microbial Threats.) American Medical Association. 1 June 2000. Accessed 4 September 2016. Vaccines are the most effective public health tool ever created.

Gwaltney, J. M. Jr. (1985). Virology and immunology of the common cold. *Rhinology*. **23**:265. [PubMed]

Hall, C. B. (2007). The spread of influenza and other respiratory viruses: complexities and conjectures. *Clinical Infectious Diseases*. 45 (3): 353–59. doi:10.1086/519433. PMC 7107900. PMID 17599315. Archived (PDF) from the original on 25 January 2016.

Harding, A. (2020). The 12 deadliest viruses on Earth - Contributing Writer, Nicoletta Lanese - Staff Writer March 04, 2020.

Hern, A. (2020). 5G confirmed safe by radiation watchdog. *The Guardian*. Retrieved May 10, 2020.

Iyer, L. M., Balaji, S., Koonin, E. V. and Aravind, L. (2006). Evolutionary genomics of nucleo-cytoplasmic large DNA viruses. *Virus Research*. 117 (1): 156–84. doi:10.1016/j.virusres.2006.01.009. PMID 16494962.

Jefferson, A., Cadet, V. E. and Hielscher, A. (2015). The mechanisms of genetically modified vaccinia viruses for the treatment of cancer. *Critical Reviews in Oncology/Hematology*. 95 (3): 407–16. doi:10.1016/j.critrevonc.2015.04.001. PMID 25900073.

Kahn, J. S. and McIntosh, K. (2005). History and Recent Advances in Corona Virus Discovery. *The Pediatric Infectious Disease Journal*. Volume **24** - Issue 11 - p S223-S227.doi: 10.1097/01.inf.0000188166.17324.60

Kawaoka, Y. (2006). *Influenza Virology: Current Topics*. Caister Academic Press. ISBN 978-1-904455-06-6. Archived from the original on 9 May 2008.

Koonin, E. V., Senkevich, T. G. and Dolja, V. V. (2006). The ancient Virus World and evolution of cells. *Biology Direct*. 1 (1): 29. doi:10.1186/1745-6150-1-29. PMC 1594570. PMID 16984643

Kubala, J. (2020). What is Intubation and Why is it Done? Medically reviewed by Scott Sundick, MD. Updated on April 13, 2020.

Kuo, L. (2020). American corona virus: China pushes propaganda casting doubt on virus origin. *The Guardian*. London.

Le Page, C., Génin, P., Baines, M. G. and Hiscott, J. (2000). Interferon activation and innate immunity. *Reviews in Immunogenetics*. 2 (3): 374–86. PMID 11256746.

Levine, D. (2020). The Deadliest Viruses on Earth. Make no mistake – COVID-19 is bad. But far worse epidemics have brought much more devastation. March 17, 2020, at 4:01 p.m.

Lodish, H., Berk, A., Zipursky, S. L, Matsudaira, P., Baltimore, D. and Darnell, J. E. (2000). *Molecular cell biology*. 4th ed. New York.

Lombard, M., Pastoret, P. P. and Schudel, A. A. (2007). Conclusions--future trends in veterinary vaccinology. *Revue Scientifique et Technique*. 26 (2): 489–94, 495–501, 503–09. doi:10.20506/rst.26.2.1759. PMID 17892169

Lytvynenko, J. (2020). Here's a Running List of Disinformation Spreading about the Corona Virus. Buzzfeed News. Archived from the original on 6 February 2020. Retrieved 8 February 2020.

Magden, J., Kääriäinen, L. and Ahola, T. (2005). Inhibitors of virus replication: recent developments and prospects. *Applied Microbiology and Biotechnology*. 66 (6): 612–21. doi:10.1007/s00253-004-1783-3. PMC 7082807. PMID 15592828.

McCarthy, T. (2020). It will disappear: The disinformation Trump spread about the corona virus – timeline. *The Guardian*. ISSN 0261-3077. Retrieved 7 May 2020.

McNeil, D. G. (2019). Religious Objections to the Measles Vaccine? Get the Shots, Faith Leaders Say. *The New York Times*. Retrieved 29 April 2019.

Murphy, J. (2020). 5 viruses more dangerous than the new corona virus. MDLinx | February 14, 2020.

Myint, S., Johnstone, S., Sanderson, G. and Simpson, H. (1994). An evaluation of 'nested' RT-PCR methods for the detection of human corona viruses 229E and OC43 in clinical specimens. *Mol. Cell Probes*. 8: 357–364. [PMC free article] [PubMed]

National Center for Immunization and Respiratory Diseases (NCIRD) (2019). Understanding Influenza Viruses. Page last reviewed: July 10, 2019.Understanding Influenza Viruses

Palese, P. (2006). Making better influenza virus vaccines. Emerging Infectious Diseases. 12 (1): 61–65. doi:10.3201/eid1201.051043. PMC 3291403. PMID 16494719

Pandharipande, P. P. (2017). Viral after effects. Intensive Care Medicine. Vol. 43, No. 9.

Piot, P. (2020). 100 Questions with Peter Piot: All your COVID-19 Queries Answered here. An interview with a TEDMED interviewer in Mar 19, 2020.

RobertsHealth, M. (2020). Flu virus with 'pandemic potential' found in China. Editor, BBC News online. 30 June 2020.

Robilotti, E., Deresinski, S., Pinsky, M. and Benjamin, A. (2015). Noro virus. Clinical Microbiology Reviews. 28 (1): 134–164. doi:10.1128/CMR.00075-14. PMC 4284304. PMID 25567225.

Sanchez, C. M., Jimenez, G. and Laviada, M. D. (1990). Antigenic homology among corona viruses related to transmissible gastroenteritis virus. Virology. 174:410. [PMC free article] [PubMed]

Schmidt, O. W., Allan, I. D. and Cooney, M. K. (1986). Rises in titers of antibody to human coronaviruses OC43 and 229E in Seattle families during 1975–1979. Am. J. Epidemiol. 123:862. [PMC free article] [PubMed]

Sherman, I. W. (2007). Twelve diseases that changed our world. Washington, DC: ASM Press. Pg. 161. ISBN 978-1-55581-466-3.

Shmerling, R. H. (2020). Be careful where you get your news about corona virus. Harvard Health Blog. Retrieved 25 March 2020.

Spaan, W., Cavanagh, D. and Horzinek, M. C. (1988). Coronaviruses: structure and genome expression. J. Gen. Virol. 69:2939. [PubMed]

Spreeuwenberg, P., Kroneman, M. and Paget, J. (2018). Reassessing the Global Mortality Burden of the 1918 Influenza Pandemic. American Journal of Epidemiology. 187 (12): 2561–67. doi:10.1093/aje/kwy191. PMID 30202996.

Tamara, A. and Tahapary, D. L. (2020). Obesity as a predictor for a poor prognosis of COVID-19. A systematic review. Diabetes & Metabolic Syndrome. Clinical Research & Reviews. 14 (4): 655–659. doi:10.1016/j.dsx.2020.05.020. ISSN 1871-4021. PMC 7217103. PMID 32438328. Retrieved 31 May 2020.

Thomssen, R. (1975). Live attenuated versus killed virus vaccines. Monographs in Allergy. 9: 155–76. PMID 1090805.

To, K. K., Tsang, O. T., Chik, Y., Yip, C., Chan, K. H., Wu, T. C. and Chan, J. M. (2020). Consistent detection of 2019 novel corona virus in saliva. Clinical Infectious Diseases. Oxford University Press. doi:10.1093/cid/ciaa149. PMC 7108139. PMID 32047895

Tyrrell, D. A. and Bynoe, M. L. (1966). Cultivation of viruses from a high proportion of patients with colds. *Lancet.* **1**:76–77.

Tyrrell, D. A., Cohen, S. and Schlarb, J. E. (1993). Signs and symptoms in common colds. *Epidemiol. Infect.* **111**:143–156. [PMC free article] [PubMed]

Verdecchia, P., Cavallini, C., Spanevello, A. and Angeli, F. (2020). The pivotal link between ACE2 deficiency and SARS-CoV-2 infection. *European Journal of Internal Medicine.* **76**: 14–20. doi:10.1016/j.ejim.2020.04.037. PMC 7167588. PMID 32336612.

Wadman, M. (2020). How does corona virus kill? Clinicians trace a ferocious rampage through the body, from brain to toes. *Science.* doi:10.1126/science.abc3208.

Warren, T. (2020). British 5G towers are being set on fire because of corona virus conspiracy theories. *The Verge.* Retrieved April 5, 2020.

World Health Organization (WHO) (2020). Novel corona virus (2020-nCoV) situation reports.

Wu, K. J. (2020). "There are more viruses than stars in the universe. Why do only some infect us? – More than a quadrillion quadrillion individual viruses exist on Earth, but most are not poised to hop into humans. Can we find the ones that are?" National Geographic Society. Retrieved 18 May 2020.