Acta Scientific Otolaryngology (ISSN: 2582-5550)

Volume 4 Issue 5 May 2022

Review Article

The Prevailing Pandemic of Coronavirus

Samreen Riaz*

Institute of Microbiology and Molecular Genetics, University of the Punjab, Lahore, Pakistan

***Corresponding Author:** Samreen Riaz, Institute of Microbiology and Molecular Genetics, University of the Punjab, Lahore, Pakistan.

Received: December 27, 2021

Published: April 25, 2022

Abstract

Coronavirus has spread all over the world in just a few months. The total number of cases of affected individuals has reached to a maximum of approximately 1,622,088 worldwide. The number of deaths caused by coronavirus is also increasing gradually day by day all over the world. The mortality rate has reached to almost 97,192. Coronavirus causes a respiratory infection which has several different symptoms like fever, dry cough etc. The whole world is in panic and is undergoing a lockdown. Many patients have also recovered. There is no vaccine for its treatment yet. The only treatment for covid-19 is by taking precautionary measures.

Many people are dying in the whole world due to coronavirus every day. Novel coronavirus is the cause of mass death in many countries. This disease started in Wuhan, China on November 17, 2019 [0, 0]. After this, due to country to country travelling, this virus spread and led to the pandemic known as COVID-19. Lately, there are 5,988 cases of coronavirus in Pakistan and 107 deaths are reported due of it. Pakistan healthcare Ministry has came into action since first case of this virus was reported in February 26, 2020 [0, 0, 0]. This pandemic also created a stressed situation in Pakistan as in the whole world. The major problem is that this disease can spread by direct contact and respiratory droplets. Pakistan's healthcare workers are doing their best to prevent people from this disease. In obligation of their duties, many of the doctors are infected and died.

Another big difficulty is that we ran out of gloves, sanitizers and masks, which are the basic commodities these days. China donated 500,000 masks to Pakistan [0]. Proper screening system and diagnosis kits are required which has increased the budget of Pakistan. In this crucial situation, our government has to take decisions very sensibly. In order to control the spread of this virus and for maintaining social distancing, several cities are lockdown. Due to this lockdown almost all the offices, shops and public areas are closed which led to the burden on the government. Many institutes are working on making vaccine for COVID-19, which also requires a huge amount of fund. This whole scenario is leading toward the situation of economic crises.

Keywords: COVID-19; WHO; SARS-CoV-2

Background

The coronavirus belongs to a family of viruses that may cause various symptoms such as pneumonia, fever, breathing difficulty, and lung infection. These viruses are common in animals worldwide, but very few cases have been known to affect humans.

The World Health Oraganization (WHO) used the term 2019 novel coronavirus that is used for a coronavirus that caused infection in the lower respiratory tract of patients with pneumonia in Wuhan, China on 29 December 2019. The WHO announced the official name of the new coronavirus as COVID19. And the reference name for the virus is (SARS-CoV-2) which stands for severe acute respiratory syndrome coronavirus 2. It was reported that many patients with pneumonia of unknown cause was linked to a local Huanan South China Seafood Market in Wuhan, Hubei Province, China in December 2019 [1].

Researches

Wuhan, China

In response to the pandemic, the Chinese Center for Disease Control and Prevention (China CDC) dispatched a rapid response team of doctors to accompany health authorities of Hubei province and Wuhan city to conduct epidemiological and medical investigations.

World Health Organization (WHO)

The WHO confirmed that the outbreak of the coronavirus epidemic was associated with the Huanan South China Seafood Marketplace, but no specific link with any animal was identified. Scientists immediately started to research the source of the new coronavirus, and the first genome of COVID-19 was published by the research team led by Prof. Yong-Zhen Zhang, on 10 January 2020. Within 1 month, this virus spread quickly throughout China during the Chinese New Year - a period when there is a high level of human mobility among Chinese people [2].

SARS and MERS

Although it is still too early to predict susceptible populations, early patients have shown a trend similar to Severe Acute Respiratory Syndrome (SARS) and Middle East respiratory syndrome (MERS) coronaviruses. Susceptibility seems to be associated with age, biological sex, and other health conditions. COVID-19 has now been declared as a Public Health Pandemic by WHO [3].

Impact on human health

Given the spread of the new coronavirus and its impacts on human health, the research community has responded rapidly to the new virus and many preliminary research articles have already been published about this pandemic.

Figure a

What is Covid-19?

Introduction

Coronavirus disease (COVID-19) is an infectious disease caused by a newly discovered coronavirus. Coronaviruses are a group of related viruses that cause diseases in birds and mammals. In humans, coronaviruses cause respiratory tract infections that can be mild and acute, such as some cases of the common cold (among other possible causes, predominantly rhinoviruses), and others that can be lethal and deadly, such as SARS, MERS, and COVID-19. Symptoms in other species vary: in chickens, they cause an upper respiratory tract disease, while in pigs and cows they cause diarrhea. There are yet to be vaccines or antiviral drugs to prevent or treat human coronavirus infections [4].

A novel strain of coronavirus — SARS-CoV-2 — was first detected in December 2019 in Wuhan, a city in China's Hubei province with a population of 11 million, after an outbreak of pneumonia without an obvious cause. The virus has now spread to over 200 countries and territories across the globe, and was characterized as a pandemic by the World Health Organization (WHO) on 11 March 2020 [5].

As of 21 December 2020, there were 75,479,471 laboratory-confirmed cases of coronavirus disease 2019 (COVID-19) infection globally, with 1,686,267 reported deaths. The number of cases and deaths outside of China overtook those within the country on 16 March 2020.

As of 21 December 2020, there have been 2,040,147 confirmed cases of the virus in the UK and 67,401 of these have died (in all settings, within 28 days of the test.

Epidemiology and pathogenesis

All ages are susceptible. Infection is transmitted through large droplets generated during coughing and sneezing by symptomatic patients but can also occur from asymptomatic people and before onset of symptoms [9]. Studies have shown higher viral loads in the nasal cavity as compared to the throat with no difference in viral burden between symptomatic and asymptomatic people [6].

Patients can be infectious for as long as the symptoms last and even on clinical recovery. Some people may act as super spreaders; a UK citizen who attended a conference in Singapore infected 11

other people while staying in a resort in the French Alps and upon return to the UK [7]. These infected droplets can spread 1-2 m and deposit on surfaces. The virus can remain viable on surfaces for days in favourable atmospheric conditions but are destroyed in less than a minute by common disinfectants like sodium hypochlorite, hydrogen peroxide etc. [8].

Infection is acquired either by inhalation of these droplets or touching surfaces contaminated by them or then touching the nose, mouth and eyes. The virus is also present in the stool and contamination of the water supply and subsequent transmission via aerosolization/feco oral route is also hypothesized [9]. As per current information, transplacental transmission from pregnant women to their fetus has not been described [14]. However, neonatal disease due to post natal transmission is described [0]. The incubation period varies from 2 to 14 d [median 5 d]. Studies have identified angiotensin receptor 2 (ACE2) as the receptor through which the virus enters the respiratory mucosa [11].

Classification of coronavirus

Coronaviruses belongs to the subfamily Orthocoronavirinae, in the family Coronaviridae. These are enveloped viruses with a positive sense single-stranded RNA genome and a nucleocapsid having helical symmetry. The genomic size of coronaviruses ranges from approximately 27 to 34 kbs and it is the largest among known RNA viruses. The name coronavirus is derived from the Latin corona, meaning "crown" or "halo", which refers to the characteristic appearance of a solar corona around the virions (which are virus particles) when observed under transmission electron microscopy because the surface is covered in club-shaped protein spikes [12].

Medical problems

Most people infected with the COVID-19 virus will experience mild to moderate respiratory illness and recover without requiring special treatment. Older people, and those with underlying medical problems like cardiovascular disease, chronic respiratory disease, cancer and diabetes are more likely to be susceptible to get serious illness.

Spreading of disease

The best way to prevent and slow down transmission is to be well informed about the COVID-19 virus, the disease it causes and how it spreads.

Transmission: The COVID-19 virus spreads majorly through droplets of saliva or nasal secretions discharged when an infected person coughs or sneezes, so it's important that we also practice respiratory etiquette (for example, by coughing into a flexed elbow).

No vaccines available

At this time, there are no specific vaccines or treatments for COVID-19. However, there are many clinical trials ongoing recently evaluating potential treatments. WHO also continues to provide updated information as soon as clinical findings become available [13].

Precautions

- We can protect ourselves and others from infection by:
- Washing your hands or
- Using an alcohol based rub frequently and Not touching your face.
- Using sanitizer
- Stay home
- Save lives
- Wear masks
- Don't shake hands
- Don't go near patients

Figure b

Symptoms of COVID-19

- The most common symptoms of COVID-19 are: Fever tiredness, and dry cough.

- Some patients may have: Aches and pains, nasal congestion, runny nose, sore throat or diarrhea
- These symptoms are usually mild and begin gradually. Some people become infected but don't develop any symptoms and don't feel unwell.
- Most people (about 80%) recover from the disease without needing special treatment. Around 1 out of every 6 people who gets COVID-19 becomes seriously ill and develops difficulty breathing.
- Older people, and those with underlying medical problems like: high blood pressure, heart problems diabetes, are more likely to develop serious illness.
- People with fever, cough and difficulty breathing should seek medical attention.

Figure c

People may be sick with the virus for 1 to 14 days before developing symptoms.

Infections caused by COVID-19

Respiratory infections

People with COVID-19 generally develop signs and symptoms, including mild respiratory symptoms and fever, on an average of 5-6 days after infection (mean incubation period 5-6 days, range 1-14 days).

Pneumonia cases

Most people infected with COVID-19 virus have mild disease and recover. Approximately 80% of laboratory confirmed patients have had mild to moderate disease, which includes non-pneumonia and pneumonia cases, 13.8% have severe disease (dyspnea, respiratory frequency ≥30/minute, blood oxygen saturation,ratio 50% of the lung field within 24-48 hours) and 6.1% are critical (respiratory failure, septic shock, and/or multiple organ dysfunction/failure).

Asymptomatic infection

Asymptomatic infection has been reported, but the majority of the relatively rare cases who are asymptomatic on the date of identification/report went on to develop disease. The proportion of truly asymptomatic infections is not clear but appears to be rare and does not appear to be a major cause of transmission.

Higher risk of disease

Individuals at highest risk for severe disease and death include people aged over 60 years and those with conditions such as hypertension, diabetes, cardiovascular disease, chronic respiratory disease and cancer. Disease in children appears to be relatively rare and mild with approximately 2.4% of the total reported cases reported amongst individuals aged under 19 years. A very small proportion of those aged under 19 years have developed severe (2.5%) or critical disease (0.2%).

Pathogenicity

Coronavirus infects many humans, causing acute and chronic diseases. The pathogenesis of severe acute respiratory coronavirus lies in the fact that this virus has two major prototypes and both are the agents of common cold.

There is also speculation that human coronavirus is also associated with more serious human diseases like multiple sclerosis.

The recently identified and studied SARS-CoV is known to cause respiratory tract infections along with showing the symptoms of pneumonia in elder patients [14].

Medications

Screening: Screening test is done on every public place such as on airports, supermarket and other places [0]. It helps to determine whether a person shows the symptoms of the disease or not. It is usually the prior step to diagnosis. In Pakistan SOPs (Standard Operating Procedures) are made for airports to stop the spreading of this virus [0]. If a person shows any signs and symptoms, he/she

is sent for the further diagnosis. Also the smokers and asthmatic persons are critically checked because they are at great risk of getting the virus.

Diagnostic kits: In Pakistan as in other countries, RT PCR is applied for the diagnosis of the virus. For this purpose diagnostic kits are devised. But, the primers for this purpose are not made in Pakistan [0]. Also many labs are working on it. Agha Khan University Hospital and Shaukhat Khanum Memorial Hospitals are working vigilantly in this regard.

Antimalarial drugs: Dr. Asad Aslam, chief executive of Mayo Hospital, Lahore has reported that Antimalarial drugs proved effective in the treatment of coronavirus [10]. Patients are recovering by the use of it. Lately, the Antimalarial drugs are used as emergency cure in Pakistan, US and other countries. In this regard, the export of hydroxychloroquine and chloroquine has stopped in order to meet the need of Pakistan [15].

Plasma therapy: In this therapy, the antibodies are being given to the infected person to fight against virus. Recently, in Dow University of medical sciences has isolated intravenous immunoglobins that is used for passive immunization. In Pakistan, Services and Mayo hospitals are using this therapy. The patient named Yahya Jaffery was first to cured from the disease and he denoted his plasma which can be used to treat other infected patients [16].

Vaccine and myths: Novel coronavirus does not have any vaccine but scientists are working on it. University of Punjab, Lahore is also working on the vaccine. There are also myths about using garlic to cure the disease because garlic builds up human immune system.

Quarantine centres: There are many self isolation or quarantine centres made in the hospitals. Many of the malls like Expo Centre is converted into quarantine centre. All the people coming from abroad are kept in these centres for isolation for approximately 14 days. Since the railway stations are closed, the train are being used as the isolation centres.

Economics

Due to the present outbreak of COVID-19, many developing countries such as Pakistan are suffering and their economy is disturbed. In current situation, the whole country is lockdown, no business running, GDP has fallen badly. It is reported that Pakistan has a loss of 1.3 trillion rupees. Pakistan's economy depends on export. Textile has 60% of the export. Since export is banned economy is totally shattered. Likewise, many other exports are also stopped. Because of closing down of markets, roads and factories, many daily wagers are facing problem. This situation has left them unemployed. They have no means of earning and have gone to the walls.

As we know, Pakistan is a great tourist's country but the lockdown created a situation that the use of petroleum is lessened. All the railway stations and airports are also shutdown. It means there is less import of petroleum. But the other aspect is that the stopping of tourism is also affecting the budget. In this situation of crisis, many NGOs are helping in building up charity and by supplying ration to people. Al-Khidmat foundation and many other NGOs are aiding people. They are truly serving the nation. Many rich people are also facilitating unprivileged people. Also, government of Pakistan has taken an action of cutting one day income of government employees to assist these daily wagers. Zakat is also being given before Ramadan. The Pakistani Government also helping the people by giving them a facility to pay utility bills in three instalments. These instalments should be are paid in three months. Prime Minister Imran Khan has set a "Corona relief fund" [16].

Figure d

Figure d

Is it possible to make progress against the pandemic?

To answer these questions we need data. But data is not enough. This is especially true in this pandemic because even the best available data is far from perfect. Much of our work therefore focuses on explaining what the data can – and cannot – tell us about the pandemic.

Our goal is two-fold

To provide reliable, global and open data and research on how the COVID-19 pandemic is spreading, what impact the pandemic has, how we can make progress against the pandemic, and whether the measures countries are taking are successful or not.

And to build an infrastructure that allows research colleagues – and everyone who is interested – to navigate and understand this data and research.

Before we study how to make progress we should consider the more basic question: is it possible to do so?

The answer is very clear: While some countries have failed in their response to the pandemic, others met the challenge much more successfully. Perhaps the most important thing to know about the pandemic is that it is possible to fight the pandemic.

Responding successfully means two things: limiting the direct and the indirect impact of the pandemic. Countries that have responded most successfully were able to avoid choosing between the two: they avoided the trade-off between a high mortality and a high socio-economic impact of the pandemic. New Zealand has been able to bring infections down and open up their country internally. Other island nations were also able to almost entirely prevent an outbreak (like Taiwan, Australia, and Iceland). But not only islands were able to bend the curve of infections and prevent large outbreaks – Norway, Uruguay, Thailand, Finland, and South Korea are examples. These countries suffered a smaller direct impact, but they also limited the indirect impacts because they were able to release lockdown measures earlier.

Together with colleagues at the Robert Koch Institute, the Chan School of Public Health, the UK Public Health Rapid Support Team, the London School of Hygiene and Tropical Medicine and other institutions we study countries that responded most successfully in detail.

The point of this work is to understand those countries so that the rest of the world can learn from them. We have published three country specific studies:

- Emerging COVID-19 success story: Vietnam's commitment to containment
- Emerging COVID-19 success story: Germany's strong enabling environment
- Emerging COVID-19 success story: South Korea learned the lessons of MERS

Together with epidemiologists Anna Seale, Dave Kennedy, and Daniel Bausch we wrote this introduction to the Pandemic Exemplar project. We will continue this work over the course of the pandemic so that the world can learn from those countries that are most successful in their fight against the pandemic.

Evolution of SARS-COV-2 during the past few months

Replication of RNA viruses could generate mutations due to the low proofreading ability of their RdRP. The genome variations generated by viral RdRP could be beneficial for an emerging virus to adapt to new hosts. However, previous studies have shown that the mutation rates could vary in RNA viruses [14]. The synonymous substitution rate for coronaviruses might be approximately 1 ×

10^{-3}/synonymous site/year, which is lower than some other RNA viruses. The mutation rate during coronavirus replication could be partially controlled by the viral exoribonuclease nsp14 [16]. Nevertheless, SARS-CoV-2 has been continuously evolving to different groups worldwide during the pandemic.

According to the information of nCoV-19 (SARS-CoV-2) sequences submitted to the GISAID database in January 2020, the virus was first collected in late December 2019 from Wuhan, China. However, those viral sequences varied from the latest submitted sequence collected in early April 2020 from North America. Since the viral sequences continuously change, the construction of a phylogenetic network is crucial to investigate the adaption of the virus in different human populations and environments. Although the virus keeps evolving within humans who could also be susceptible to other human coronaviruses, recombination between SARS-CoV-2 and old human coronaviruses, such as HCoV-229E, OC43, NL63, and HKU1, has not been found. Nevertheless, a recent study claimed that three genetic types of the virus have been circulating globally [1]. The study demonstrated that the genotypes could also correlate to the geographic locations, while the sample size and analysis methods in the study are still being argued in the research field. Therefore, it is still unclear whether the evolution of SARSCoV-2 could be affected by replication environments, such as genetic and immunological restrictions in different human populations. With evolutionary pressure, the selection of SARS-CoV-2 mutations will be ongoing. The investigation of the geographic patterns of SARS-CoV-2 variations will provide information on vaccine development for different populations.

How is the infection diagnosed?

Most tests currently used to diagnose active SARS-CoV-2 infection are polymerase chain reaction (PCR)based, due to the technique's high sensitivity and specificity.

The first diagnostic assay to be published by the WHO as a guideline for diagnostic detection was developed at the German Center for Infection Research in January. Since then, several other tests have been developed by groups around the world.

Despite PCR's dominance, interest is growing in the development and use of tests based on alternative technologies, such as CRISPR, loop mediated isothermal amplification (LAMP), and mass spectrometry. Several studies have also recommended the use of imaging technologies such as chest CT's and lung ultrasound to assist in the diagnosis of COVID-19.

With the need for more frequent, large-scale testing to help efforts to control the spread of the virus, there has been a push for faster, cheaper, more portable tests, and the use of alternative sample sources, such as saliva.

In addition to tests that detect active infection, a range of antibody tests are being developed to identify individuals who have previously been infected. The results of such tests could be used to help study past exposures, identify convalescent plasma donors and estimate levels of immunity within a population.

COVID-19 test development has encountered a number of obstacles so far during the pandemic, with reagent shortages, questions regarding reliability and caution urged when interpreting antibody test results being just some of the hurdles encountered. However, the development and implementation of efficient tests is crucial in efforts to reduce the spread of SARS-CoV-2, with testing, isolation and contact tracing being referred to as "the backbone of the response" by Dr Tedros Adhanom Ghebreyesus, WHO Director-General, in a media briefing on March 16, 2020.

All these means are for facilitating the nation and to protect them from this pandemic. But the peak of coronavirus cases is increasing day by day since the first case as shown in figure 1.

Figure 1: A line graph showing no of coronavirus cases rising month by month.

New strain of corona virus found in UK

It is really common for viruses to undergo mutations, seasonal influenza mutates every year. Corona virus is also mutating with time, this virus is mutating at a rate of 1 to 2 changes per month.

In the month of December the PHE (Public health England's) observed a rapid increase in number of cases of corona patients in Kent and London. Then they observed that a different strain of corona virus is present in those patients. They named that variant as 'VUI - 202012/01' (the first Variant Under Investigation in December 2020) or B.1.1.7.

On 13th December, 1,108 cases were identified with this variant new strain in east and south of London (according to PHE). PHE is working on this strain from that time and but there is no evidence about what are the effects of this mutation on the severity of disease or vaccine efficiency.

There are a total of 17 mutations found in this strain. Among these mutations eight mutations are in the gene that encodes the spike protein (it is the key to our body cells). One mutation called "N501Y" alters the most important part of the spike, known as the "receptor-binding domain". Change in spike protein might make this strain more infectious and easy to spread. Other mutations might affect host immune response reducing the efficiency of current vaccine.

Dr Javed Akram, Vice Chancellor of the University of Health Sciences, on Wednesday (23rd December 2020) said:

- "The new Coronavirus strain has the potential to affect the younger population and children".
- He also said that, "Its transmission potential is also more than 50%".

This variant might have already spread to other countries. Netherlands have identified a patient with this strain, Germany is also looking for this kind of strain in their patients, Spain also confirmed cases with this mutated Coronavirus (reported on 26th dec), a person from Sweden has also tested positive for this new strain (reported on 26th December), five patients identified in Japan and Ireland has also found this mutated strain. All these patients have recently returned from U.K.

This new strain has badly affected the traveling as many countries (such as Japan, South Korea, China, Philippines) have banned the arrival of flights to and from U.K. this travel restriction will also affect the economy.

Here is graph showing the spread of this variant in different areas of England

Figure f

Vaccination

The world is in the midst of a COVID-19 pandemic. As WHO and partners work together on the response -- tracking the pandemic, advising on critical interventions, distributing vital medical supplies to those in need--- they are racing to develop and deploy safe and effective vaccines.

Vaccines save millions of lives each year. Vaccines work by training and preparing the body's natural defences --- the immune system--- to recognize and fight off the viruses and bacteria they target. If the body is exposed to those disease-causing germs later, the body is immediately ready to destroy them, preventing illness.

There are currently more than 50 COVID-19 vaccine candidates in trials. WHO is working in collaboration with scientists, business, and global health organizations through the ACT Accelerator to speed up the pandemic response. When a safe and effective vaccine is found, COVAX (led by WHO, GAVI and CEPI) will facilitate the equitable access and distribution of these vaccines to protect people in all countries. People most at risk will be prioritized. While we work towards rolling out a safe and effective vaccine fairly, we must continue the essential public health actions to suppress transmission and reduce mortality.

The COVID-19 candidate vaccine landscape

- The COVID-19 candidate vaccine landscape database compiles detailed information on COVID-19 vaccine candidates in development.
- The landscape is updated regularly - twice a week (Tuesday and Friday, 17:00 CET).
- The landscape: provides summary tables of COVID-19 vaccine candidates in both clinical and pre-clinical development; provides analysis and visualization for several COVID-19 vaccine candidate categories;
- tracks the progress of each vaccine from pre-clinical, Phase 1, Phase 2 through to Phase 3 efficacy studies,
- provides links to published reports on safety, immunogenicity and efficacy data of the vaccine candidates;
- includes information on key attributes of each vaccine candidate; and
- allows users to search for COVID-19 vaccines through various criteria such as vaccine platform, dosage, schedule of vaccination, route of administration, developer, trail phase and clinical endpoints being measured in Phase 3.

Conclusion

This study shows a holistic picture of the current research in response to the outbreak of COVID-19. During this early period, many studies have been published exploring the epidemiology, causes, clinical manifestation and diagnosis, and prevention and control of the novel coronavirus. Thus far, most studies have focused on the epidemiology and potential causes. However, studies exploring prevention and control measures have begun to gradually increase. Studies in this domain are urgently needed to minimize the impact of the outbreak. Government agencies have quickly incorporated recent scientific findings into public policies at the community, regional, and national levels to slow down and/or prevent the further spread of the COVID-19. We recommend that the scholarly community conduct further research to provide valid and reliable ways to manage this kind of public health emergency in both the short-term and long-term. Coronavirus is a deadly disease. It can affect any person. But the researches are going on about its vaccine, cure and prevention in the whole world. It has badly affected the developing countries. We are suffering from the crisis but there are the pillars of the country still present. All the doctors, paramedics and forces in the country are striving in this battle. They are using all the medications effectively. Pakistani government is also doing its best to stabilize the economy. We only hope for the best that this pandemic does not last for much long time.

Acknowledgement

We would like to thank Dr. Samreen Riaz, Assistant Professor at Department of Microbiology and Molecular Genetics,University of the Punjab, Lahore, Pakistan. for her valuable time, guidance, suggestions and ample moral support in this regard of writing this article.

Bibliography

1. "BMJ Best Practice" (2020).
2. "Updated WHO advice for international traffic in relation to the outbreak of the novel coronavirus 2019-nCoV". World Health Organization (2020).
3. World Health Organization (2020).
4. Paules CI., *et al*. "Coronavirus Infections—More Than Just the Common Cold". *Journal of the American Medical Association* 323.8 (2020): 707-708.
5. Esper F., *et al*. "Human coronaviruses are uncommon in patients with gastrointestinal illness". *Journal of Clinical Virology* 48.2 (2010): 131-133.
6. Centers for Disease Control and Prevention (2020).
7. Otrompke J. "Everything you should know about the coronavirus pandemic". *The Pharmaceutical Journal* 293 (2014): 7833.
8. "Severe Acute Respiratory Syndrome (SARS)". World Health Organization (2004).
9. "Middle East respiratory syndrome coronavirus (MERS-CoV)". World Health Organization (2019).
10. Centers for Disease Control and Prevention. (2017).
11. Bai Y., *et al*. "Presumed Asymptomatic Carrier Transmission of COVID-19". *Journal of the American Medical Association* 323.14 (2020): 1406-1407.
12. Ji W., *et al*. "Intermediary asset pricing in commodity futures returns". *Journal of Medical Virology* 40.11 (2020).

13. Callaway E and Cyranoski D. "Why snakes probably aren't spreading the new China virus". Nature (2020).

14. Singhal T. "A Review of Coronavirus Disease-2019 (COVID-19)". *Indian Journal of Pediatrics* 87 (2020): 281-286.

15. Max Roser., *et al.* "Coronavirus Pandemic (COVID-19)" (2020).

16. Phelan AL., *et al.* "The novel coronavirus originating in Wuhan, China: challenges for global health governance". *Journal of the American Medical Association* 323.8 (2020): 709-710.