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The 21st century disaster: The COVID-19 epidemiology, risk factors and control

Abstract

The 21st century will be indelible in the world as ruin of the outbreak of COVID-19 was arose in Wuhan, China has now spread all over the world, up to August 2020. This study was based on the factors affecting the epidemiology of this virus in human societies of global concern. We studied the articles published in journals on various aspects of nCoVID19. The Wikipedia and WHO situation reports have also been searched out for related information. Outcomes were followed up until 2020.The COVID-19 is a virus with pandemic potential which may continue to cause regular infection in human. The pandemic outbreak of COVID-19 threatened public health across the globe in form of system as reflected in the shape of emergency. Approximately 21 million humans are infected and 759,400 have lost their lives till 2020 in all over the world. We have described epidemiological features, reservoirs, transmission, incubation period, rate of fatality, management including recent clinical chemotherapeutic approach and preventive measurements and masses which are at risk of COVID19. This virus causes viral pneumonia when it attacks on respiratory system and multiple failure which can leads to life threatening complications. It is believed to be zoonotic importance although it is not clear from which animal and how it is transmitted. Zoonotic transmission of COVID-19 has not yet known by science. The current study will help to establish a baseline for early effective control of this rapidly spreading severe viral illness. The available data on COVID-19 indicates that older males with comorbidities would have been more infected, which can result in severe respiratory complications. Implementation of preventive measurements, investigation of proper chemotherapeutics and detection of cross species transmission agents must be ensured.

Key words: COVID-19, Pandemic outbreak, Respiratory infections, Viral infections, Global health disaster

1. Introduction

The life-threatening infections Severe Acute Respiratory Syndrome (SARS) and Middle East Respiratory Syndrome (MERS), which arose in 2003 and 2012, respectively, have persisted. Recently, when the globe was entangled in dealing with the MERS CoV, another highly contagious corona virus by the name 2019-novel corona virus appeared in Wuhan, and became the center of viral pneumonia which by the time was not identified as covid-19.The pandemic of SARSCoV-2 was originated in Wuhan, Hubei Province, China for the first time, in the last quarter of December 2019. Scientists of Chinese Centre for Disease Control (CDC), On Jan 7, isolated a SARS CoV-2 from the specimens of swab taken from throat of patient, WHO named it 2019-nCoV successively (WHO, 2020a).On30th January WHO declared public health emergency internationally (Zhang et al., 2020). Lateron, on 11th March, this threat, of international health concerned, was recognized as epidemic disease (WHO, 2020b). So for, till 15TH August 2020, over 21 million https://en.wikipedia.org/wiki/2019%E2%80%9320_coronavirus_pandemic - cite_noteJHU_ticker-4 people were infected with COVID-19 in over 200 countries which have led to approximately cases of 759,400 death in the world. As contrary to these cases, more people have recovered from COVID-19 since the recovery rate of patient with no comorbidities is 80%. Two out of sixteen people become seriously ill, especially elder people with comorbidities and showed difficulty in breathing (WHO, 2020b).

2. Epidemiology

The nCov-19 outbreak was happened in Wuhan, China for the first time, in the last quarter of December 2019, and it was initially confirmed by the scientists in China on January 7, 2020, from a patient's throat swab sample. Following its discovery, WHO designated this new virus as 2019-nCoV. Human infected with this novel virus develop acute respiratory disease syndrome (ARDS), including pneumonia, pulmonary oedema etc, and multiple organ failure as a matter of fact, the heart-rending circumstances is that nCoVID-19 has occupied over 200 countries. The looming shadow of impending death hover over the entire world like the shuddering suffering of grief as the scourge has more than 839,500 laboratory definite cases and 41,000 deaths in the world up to March 31st, 2020 (Karim *et al*., 2020). Millions of people are challenging the confrontations caused by this viral contagion as it induces the world folk to put into practice the curse of isolation and quarantine. The occurrence of nCOVID-19 is posturing and intimidating potential challenges to health systems of the globe and it has been remained high-ranking upshots on the world economic spectrum (Kupferschmidt and Cohen, 2020).The factors effecting on the epidemiology of any epidemic depends upon the number of cases reported, how much faster the disease can spread, clinical severity, how the virus is transmitted and how they infect a person and the risk factor and mortality rate.

3. Structure

The structure of corona viruses is composed of glycoprotein spikes which give them crown like shape. Comparatively large in size, it consists a single-strand positive-sense RNA. The so called reported species of corona viruses infects animals, such as bats, and humans (Anthony*et al*., 2017). Corona viruses have been classified as alphaCoVs, betaCoVs, gammaCoVs, and deltaCoVs. The nCOV-19 has been placed in the class betaCoVs in where the previous famous viruses SARS and MERS had been classified by virologists.

Moreover, nCOV-19 has designated as SARS-CoV-2 which resembles SARS and MERS-CoVs. These viruses cause pneumonia, in lower respiratory tract, and failure of multiple organ system including hepatic, renal, heart and central nervous system (Zhu *et al*., 2020). SARS-CoV-2 is more pathogenic, because of its high rate of transmission as compared to SARS and MERS-CoVs (Tang *et al*., 2020).

Covid-19 is accommodated in single stranded RNA corona viruses. This major pathogen causing respiratory diseases and can spread quickly (Perlman *et al*., 2009). CoVS have the ability to cause resistance to human immune system and can transmit diseases such as common cold, and in severe case causes MERS, SARS also COVID 19. The recent viruses originated from Bats, and are transmitted to other mammalian host.

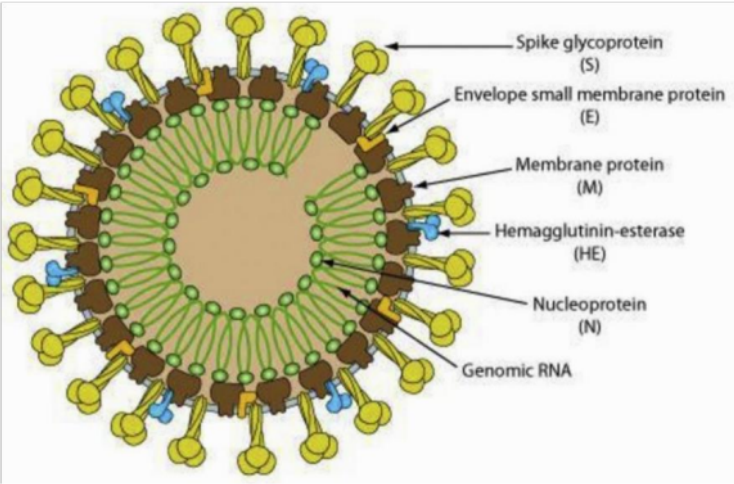


Fig. 1. http://ruleof6ix.fieldofscience.com/2012/09/a-new-coronavirus-should-you-care.html)

CoVs have sphere-shaped enveloped particle composed of single strand RNA linked with nucleoprotein in a capsid composed of matrix protein, the outer structure has clubbed-shaped glycoprotein projection. Few corona viruses have hem agglutinin- esterase protein.(DE Haan et al., 1998). The genome of corona viruses is very complex as compared to other viruses. Coronavirus genome is the largest (26.4-31.7kb) in all known RNA viruses (Mousavizadeh et al., 2020)

4. Reservoirs

The reservoir hosts for previously known corona viruses (SARS & MERS) were investigated by the scientists as both of them are originated from bats. In addition to the reservoir hosts, civet, cats and camels were confirmed to be the cross species transitional hosts between bats and humans respectively. The previous studies shows that SARS-CoV-2 was found identical at 96% to other corona viruses and it is therefore considered that bat may the native host (Lu *et al.*, 2020). The cross-species barrier between bats and humans is yet to be known by science. Some of the scientists blamed snake is filling the gap between bats and humans (Ji *et al.*, 2020a) while some others propose pangolins as the responsible host to fill this gape however they provide the evidence of 99% genetic similarity in a corona virus found in pangolins (Xiao *et al.*, 2020).

5. Transmission

The initially infected individuals with COVID-19 were related to the Wuhan wet market where animals are used for food purpose which point a finger that it have zoonotic origin. After studying the virus for two snake species were identified for that might be possibly the reservoir for COVID-19 (Rothan *et al.*, 2020). But there are no scientific proof for the reservoir corona virus as for avian and birds and mammalian fauna (Ji *et al.*,2020b).Genetic composition of SARS-CoV-2 shows that it is 88% identical to the bat SARS like corona viruses (Lu *et al.*,2020;Wan *et al.*, 2020) which shows that mammals are likely filling the gap among humans and COVID-19. Human to human transmission is possible since during isolation if one person of family that went outside and got infected likely infected other family members which had no contact with other humans or outside world. And it's occurred most likely through sneezing coughing and water droplets from infected person mouth. However, the transmission from mother to fetus or through vaginal birth is not yet confirmed.

Receptor binding is the first step in a viral infection in the host cell, secondly fusion with the host cell membrane. Which makes the lung epithelial cells the prime targeted site for the corona virus. The covid-19 and SARS-CoV have matching sequence for receptor-binding, which can easily be entr into host cells through ACE2 receptor (Wan *et al.*, 2020) but as described that animals are

source of transmission (Ahmad et al., 2020). It is known by the science that SARSCoV-2 is 96% similar to a coronavirus of bat (Rodriguez-Morales *et al*., 2020).

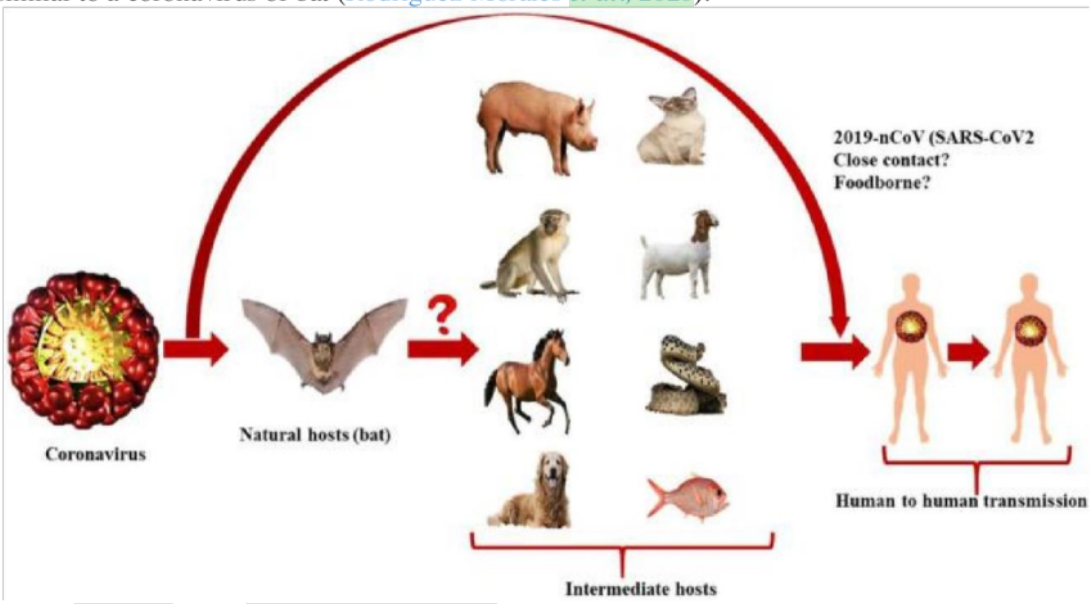


Fig. 2. Potential cycle for the transmission of SARS-COV2 (Ahmad et al., 2020)

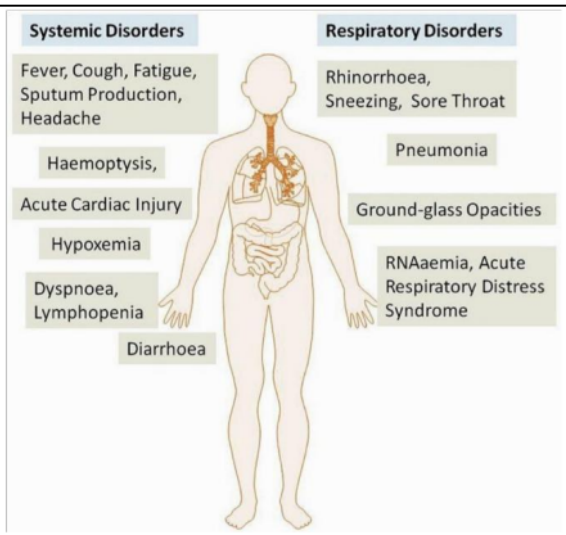
It is a fact that corona viruses can transmit from animals to humans. However, it is evidenced by the research that SARS-CoV-2 is more contagious because of its high rate of transmission from human to humans than SARS-CoV. Covid-19 transmission in humans is similar to that of MERS-CoV, which is spread through sneezing droplets or by contacting contaminated surfaces (Chu et al., 2014; Zumla et al., 2015). In current scenario, the transmission of the SARS-CoV-2 from one human to another was evidenced by the research work of Chan et al., 2020). The transmission of SARS-CoV-2 has also been investigated from fecal materials to humans, isolated from feces specimens of SARS-CoV-2 infected patients (Wang *et al*., 2020).

6. Incubation period

A maximum seven days period is required for incubation of SARS-CoV-2 (WHO, 2020b), however incubation period can ranged from 2 days to 2 weeks was reported for MERS-CoV (Chan *et al*., 2020). According to Li et al., 2020, the average period of incubation for SARS-CoV2 was ranged from 1 to 14 and 3 to 7 days. However, an average incubation period was ranged from 0 to 24 days (Guan et al., 2020), 3.0 to 7.2 days (Yang et al., 2020).

7. Symptomology

Full list of clinical sign and symptoms of COVID-19 patients has been investigated by various researchers during the ongoing outbreak. These signs and symptoms have been evidenced rather in a significant number of individuals of the population. So the signs and symptoms which can be linked specifically to COVID-19 include firstly, breathe shortness with cough that become more severe with the passage of time, secondly, slight fever that grows gradually. These symptoms may lead to complications in the form of trouble breathing. Other symptoms may include blue lips or face, tireless pain, unnecessary tiredness. Cough, runny nose, sneezing, sore throat, fever, headache, fatigue, chills, and body aches were also noted by some of the researchers. Appropriate clinical approaches must be investigated COVID-19 infected patients. COVID-19 infection is expected to be more likely in patients with compromised immune



Systems (Rothan et al., 2020).

Fig. 3. COVID-19 infection causes systemic and respiratory problems (Rothan et al., 2020).

8. Fatality rate

For investigation of fatality rate we will take time to examine and understand the virus (Wu et al., 2020a) but according to summary of the report on 72314 COVID-19 cases have proved 2.3% death rate due to COVID-19. The average death rate was 2.11% in Pakistan noted by Khan et al., 2022.

9. High risk masses

The majority of studies have been carried out in to comprehensively investigate the advantages and disadvantages of the acute issue, from beginning to end. The current study has also addressed some of the risk factors which have been approached and published by the scientists in the notable journals. More and more studies are going to be published on cases of COVID-19 (Yang et al., 2020b).

9a. Age

Based on findings of recent studies, the rate of mortality caused by nCOVID-19 is variable amongst the age of infected individuals from the age point of view as: 0.06% in age up to 20years, 8.6% in 70 years and 13.4% in those 80 years in age (Kaplan, 2020). According to recent laboratory findings, people in their later years are more likely to acquire ARDS, which can lead to mortality due to their weakened immune systems (Wu et al., 2020b).

9b. Gender

In the same way as being older is prominent risk factor for getting COVID-19, some researchers have found that males are more affected than females (Guzman, 2020). More deaths have been reported in Italy since April 1, 2020, followed by Spain (https://www.cdc.gov/coronavirus/2019ncov/cases-updates/summary.html). While the likelihood of infection differs between males and females is still unknown, research in Italy, China, and other nations suggest that males die at a higher rate than females. This finding has the potential to be genetically, behaviorally, or biologically significant. According to scientists, females have a more robust immune system than males. Genealogy and endocrine system are other prime factors of discussion (Guzman, 2020).

10. Comorbidities (people with pre-existing diseases)

Age and gender have been regarded as the key risk features for COVID-19, however any one person with comorbidities and irrespective of their age or gender is to be considered as well

(https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/prevention.html. People with chronic lung disease, severe cardiac issues, chronic kidney disease, and diabetes have also been identified as COVID-19 risk factors (https://www.cdc.gov/coronavirus/2019-ncov/preventgetting-sick/prevention.html).

It has been evidenced in China that infections have always posed threat to diabetic patients. Diabetic people are more likely to develop morbidity, which increases their chances of catching the virus (Madjid et al., 2020; Avril et al., 2020). Diabetes is a hazard because it damages the circulation system and delays healing. The immune system is hindered when the body is disposed to infection owing to uncontrolled blood sugar (Madjid et al., 2020).

Chronic obstructive pulmonary disease (COPD), asthma, cystic fibrosis, bronchitis and other respiratory illnesses may develop in patients with lung diseases. COVID19 can cause congenital heart failure, artery obstructions, and blood vessel blockages in patients with cardiovascular disease, which can lead to strokes or heart attacks (Avril et al., 2020).

Immune-compromised persons are also coming on at risk group posed by COVID-19. The immune-compromised are those who have suffered an organ transplant or cancer therapy, smokers, one who has prolonged history of corticosteroids or uses any other medications which can weaken immune system (Avril et al., 2020).

11. Diagnosis

11a. Clinical Diagnosis

During the clinical diagnosis of SARS-COV-2, doctors were aware of both typical and non-typical symptoms. Fever, tiredness, dry cough, dyspnea, congestion in the nose, runny nose and other common symptoms included (Weiss and Leibowitz, 2011; Holshue et al., 2020). Fever is one of the regular symptoms of SARS-CoV-2 infection (Guan et al., 2020).

11b. Physical diagnosis

Physical diagnosis of individuals infected with SARS-CoV-2 often shows mild symptoms, through which could be or could not be confirmed the signs of disease. However, breathe shortness, moistures in lungs, weakness in breathing, percussion dullness, and up down in tactile speech tremor etc may be shown even in serious condition of the patients (Yang, 2020a).

11c. Chest X-rays vs CT-diagnosis

The computerized tomographical scan images and chest X-rays images may be variable depends on age of the patients, stages of disease, status of immunity, other comorbidities and interventions of drugs to the patients. *Chest X-ray* show interstitial alterations with shadows of small patches. During examination by Chest CT scan, lung lesions are presented more clear by CT than plain *X-rays*. In case of children infection with SARS-CoV-2, lesions with multiple lobes may be present in both lungs. Moreover, images could be taken with chest x-rays or chest CT. In case of lacking the accessibilities to the laboratory facilities for reliable diagnosis the typical ground glass lung opacities in chest CT may also be considered as confirmed cases especially when the patients have identified and quarantined (Yuen et al., 2020). A study conducted by Chung et al., 2020 on CT scans with SARS-CoV-2 ill persons showed 21% (normal CT scans), 57% (ground-glass opacity), 29% (ground-glass opacity and consolidation of lungs). Bilateral lung infection was reported by chest radiography in 41 confirmed cases with SARS-CoV-2 patients. The similarity was reported in images reported for CoVID-19 to those with SARS (Ooi et al., 2004) and MERS (Das et al., 2015).

11d. Diagnosis of COVID-19

Laboratory diagnosis of SARS-CoV-2 cases is the most important step as to distinguish SARS-CoV-2 cases from other known viruses and pneumonia cases of various agents. SARS-Cov-2 cases should separate from other individuals of the society (Jin et al., 2020). Determination of CoVID-19 mostly includes on isolation of virus and detection of viral nucleic acid. The rRT-PCR as laboratory technique is one of the most reliable technique to be used to detect the RNA of SRS-CoV-2. This technique can be applied to ensure the infected individuals by sputum collection or any other specimen from the infected individual. The blood test of an individual can determine whether an individual has earlier been infected when antibodies are found for anti-SARS-2 (Huang et al., 2020) already used for MERS-CoV (Lee et al., 2003. ELISA kits for detection of IgM and IgG antibodies for SARS-CoV-2 proteins could also be used. This technique is still in urgent need, and would be placed 2nd after highly complementary test as to viral RNA detection. Specimens from oropharynx and nasopharynx, and lower parts of respiratory system such as trachea extract, sputum, tissues of lung, blood and feces should be tested on time (Yu et al., 2020). Timely detection of RNA of the SARS-CoV-2 is the most important step in identification of the cases (Yu et al., 2020). It should be keep in mind that in initial stage of the infection, the leukocytes remain normal or decreased, lymphocytes decreases or increased and monocytes remain normal is the indication of CoVID-19 diagnosis (Jin et al., 2020).

12. Control of COVID-19

SARS-CoV-2 is a virus with pandemic potential which causes the world on alert for the first time in history. It is therefore none of the specific drugs are available in the market for the patients of this deadly virus infection. Moreover, the available drugs for the treatment of other infectious diseases and antivirals are uses. These drugs have been proposed by the experts in the relevant field. The scientists of the field have been able to quickly respond the following list of available drugs for the treatment of COVID-19.

Table 1: supportive drugs used for CoVID-19 and their probable action

Drug	Disease indication	possible action on COVID-19	Reference
baricitinib	Rheumatoid arthritis	inhibit the inflammatory process	(Richardson et al., 2020)
Lopinavir	HIV infection	prevent the viral proteases: 3CLpro or PLpro	(Zeldin, 2004)
Ritonavir	N/A	N/A	(Sheahan et al., 2020)
darunavir	HIV infection	N/A	(Kangji and Feiyan, 2020)
favipiravir (favilavir)	A viral infection	acts as an alternate substrate leading to inaccurate viral RNA synthesis	(Guo 2020)
remdesivir	Ebola virus	block viral nucleotide synthesis to stop viral replication	(Sheahan et a., 2020; Guo, 2020; Wang et al., 2020)

Ribavirin	RSV infection, hepatitis C, some viral hemorrhagic fevers	N/A	(Liu et al., 2020; Guo, 2020)
galidesivir	hepatitis C, Ebola virus, Marburg virus	N/A	(Warren et al., 2014)
BCX-4430 (salt form of galidesivir)	hepatitis C, Ebola virus, Marburg virus	N/A	(Warren et al., 2014)
*Arbidol	influenza	interrupt the binding of viral envelope protein to host cells and stop entry of virus to the target cell	(Kangji and Feiyan, 2020)
chloroquine	malarial parasite infection	elevate endosomal pH and interfere with ACE2 glycosylation	(Guo, 2020; Wang et al. 2020)
nitazoxanide	protozoal, helminth and viral infection	stop viral protein expression	(Guo, 2020)

13. Control of COVID-19

Strict measurement should be followed to control person-to-person transmission of corona virus outbreak. Special effort should be taken to reduce the transmission and isolation should be adopted by susceptible people even health care workers, children and elder people of the society. The early death of COVID-19 patients occurred mainly in elder people and people with existing health problems which might be the result of weak immune system (Wang et al., 2020). Decontamination of public areas should occur routinely. Contact with wet or contaminated objects can lead to infection of the virus such as urine that can become a bridge for transmission of COVID-19 (Lee et al., 2003). Cleaning of hands avoiding social gathering and places where someone sick might be present is a best way of controlling the virus (WHO guidelines). Vaccination is the most important strategy for control of SARS-CoV-2 infection. Several types of COVID-19 vaccines are available in different parts of the globe. The World Health Organization (WHO) keeps a current list of vaccine candidates that are being considered (WHO, 2020c).

14. Concluding remarks of the authors

SARS-CoV-2 (CoV-19) is a pathogen of the millennium, it caused severe illness and fatality all over the world. The scenario turned the worst when the required techniques of diagnosing and identification are unavailable in most parts of the world for providing early and accurate diagnosis of the disease. In case of novel corona virus-19 (SARS-CoV-2), most of the questions have unanswered so for, such as what's the absolute origin of the nCoV-19? Possible reservoirs/hosts of the nCoV-19? and exact treatment of the nCov-19?.Advance small and large scale research, surveys, case studies and projects must be launched, with a great sense of responsibility, to enhance the progress of an effective therapeutic control and prepare vaccination. Vaccines for the treatment of this viral infection have been developed by some countries and are now available for the treatment of this unique virus. In any case, extraordinary efforts and research are planned for the investigation of this huge and terrible disaster. To avoid this life-threatening virus and the illnesses it causes, widespread awareness, monitoring, and surveillance are critical. It is indispensable to amplify the research efforts on nCoVID-19 as recognized as SARS-CoV-2. It will, definitely,

solidify the scientific basis and will endow with a solid platform for important decisions for the future of the world (Holmes et al., 2021).
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15. Recommendation for future control

If not taken precaution with pathogens in future which can spread rapidly that will always do more damage than necessarily and like COVID-19 they can take the shape of pandemic. So far we know about transmission of COVID-19 and we have to take certain actions to decrease the transmission of the current pathogenic outbreak worldwide. Susceptible personals should be isolated and put under examination for further sign and symptoms. The early deaths occurred in people of old age which might be the result of weak immune system that allowed faster spread of disease (Wang et al.,2020; Li et al.,2020) which means old people should be more careful and avoid public places. People that might be infected and also healthy people should cover their face in public, and public places should provide decontaminating reagent for the purpose of cleaning hands as well other contaminated objects. Objects that are commonly used by public should be decontaminated regularly. Develop countries such as U.S is already using screening methods and other prevention and control methods to stop the virus from further spreading (Yang, J et al.,2020). Further changes in the epidemiology should be monitored continuously with route of transmission and evolution in the COVID-19 virus. Vaccinations should be ensured for the control of this pandemic as several types of vaccines have been prepared by various countries in the world. Questions such as the intermediate host and reservoir host needs to be found in order to control further spread of the virus. Other questions which include how many people have been infected so far and number of cases with acute or chronic symptoms also how many people have developed anti bodies against the virus which can all be achieved by testing all population which can provide a solid base for the treatment and control of COVID-19.

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