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COVID-19: A Pandemic Situation

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Abstract

Pandemic can be described as the widespread occurrence of disease, which is more than what is usually expected in a geographical area. Presently the whole world is in a critical state for COVID -19 pandemic. On 11th March 2020, World Health Organization took out the census of the total cases of COVID-19 and categorised it as a pandemic. On 14th April 2020, there were in total 1,925,571 coronavirus affected cases worldwide, with a death count of 119,718 and a total of 452,188 recovered cases with India having total of 10, 453 cases with a death toll of 358. People of all ages have shown susceptibility. Mode of transmission is via big droplets expelled out by symptomatic patients while they cough or sneeze. So far there is no particular drug or vaccine present in the market which is specific to the treatment of this infection. Thus, there is over-burdening of the health care systems in all places. This novel virus outbreak has challenged the infrastructure of economy, medicine and public health of almost all the countries. Also, future outbreaks of zoonotic viruses and pathogens are probable. So, besides counteracting this outbreak, we must also put our efforts in planning out comprehensive strategies to avoid any potential outbreaks of zoonotic origin.

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INTRODUCTION

There has been a lot of speculation about the word "pandemic" and how do we correctly identify it. The term pandemic has been subjected to many controversies in scientific publications and media. In recent times pandemic has been defined as "extensively epidemic", "epidemic over a very wide area and usually affecting a large proportion of the population", and "distributed or occurring widely throughout a region, country, continent or globally" (Morens *et al.*, 2009). According to World Health Organisation (2010)- "A pandemic is the worldwide spread of a new disease" (WHO, 2020a)

Pandemic can thus be described as the widespread occurrence of disease, which is more than what is usually expected in a geographical area. Presently the whole world is in a critical state for COVID -19 pandemic. It is an infectious disease mainly affecting the respiratory system and is caused by a newly discovered strain of Coronavirus which spreads through saliva droplets or nasal discharge when an infected person undergoes coughing or sneezing. Future course of COVID-19 is unknown and the knowledge related to the virus is still in the evolving stage. Thus, the aim of the article is to present before the readers the course of COVID-19 and its progression so far as a pandemic.

FEW OF THE WORST PANDEMICS IN HISTORY

Plague of Justinian

Period

541 - 542 AD (the Byzantine historian Procopius first reported in 541AD from port of Pelusium which is located close to Suez in Egypt).

Origin

Central Asia (Tian Shan - on the borders of Kyrgyzstan, Kazakhstan & China)

Disease

Bubonic plague caused by Bacteria (*Yersinia pestis*). Vector was fleas (an insect) and the reservoir were rats.

Prevention

Plague Vaccine.

Death

25 million - 100 million (it may be less per recent reports), killed 5000 people per day. The disease is now very much under control & currently there are around 600 cases per year globally.(Staff, n.d.)

Third Cholera pandemic

Period

1852 - 1860

Origin

Bengal, India (1st & 2nd pandemic cholera also originated in India)

Location of spread

Worldwide (mainly Asia, Europe, North America, Africa)

Disease

Bubonic plague caused by *Vibrio cholerae*

Death

Over a million people (23,000 in Great Britain). Of the seven pandemic of cholera, the third cholera outbreak had the highest fatalities. (Díaz and Donato, 2008)

Black Death (Second Plague Pandemic)

Period

1346 - 1353

Origin

Asia

Location of spread

Europe, Africa, and Asia

Disease

Bubonic plague caused by Bacteria (*Yersinia pestis*). Vectors are rat fleas (*Xenopsylla cheopis*). Reservoir-rodents(rats)

Death

Killed one-third to one-half of Europeans. Caused 50 million deaths worldwide (Anker, 2001; Staff, 2020)

Third Plague pandemic

Period

1774- 1940s.

Origin

Yunnan region of southwest China.

Location of spread

All inhabited Continents.

Disease

Plague caused by Bacteria (*Yersinia pestis*). Vectors are rat fleas (*Xenopsylla cheopis*). Reservoir-rodents(rats).

Death

12 million in India & China (10 million in India alone). In 1894, there was a major outbreak of Third Plague in Hong Kong which killed nearly 10,000 people, then the number of cases dropped within few weeks. In Europe during the period between 1899 to1947, there were total 1692 cases and 457 deaths. There was an outbreak of Bubonic plague in India in 1994 (26 August - 18 October) in the Southern region. Central & Western India had a total of 693 suspected cases & 56 deaths. In 1939, a total of 26257 people died from plague in India. Bramanti *et al.* (2019)

Russian Flu pandemic

Period

1889 - 1890

Origin

Bukhara in Central Asia (Turkestan)

Location of spread

Worldwide (mainly Northern Hemisphere)

Disease

Influenza A virus subtype H3N8

Death

Over a million people (Staff, n.d.)

Sixth Cholera pandemic

Period

1910 - 1911

Origin

India

Location of spread

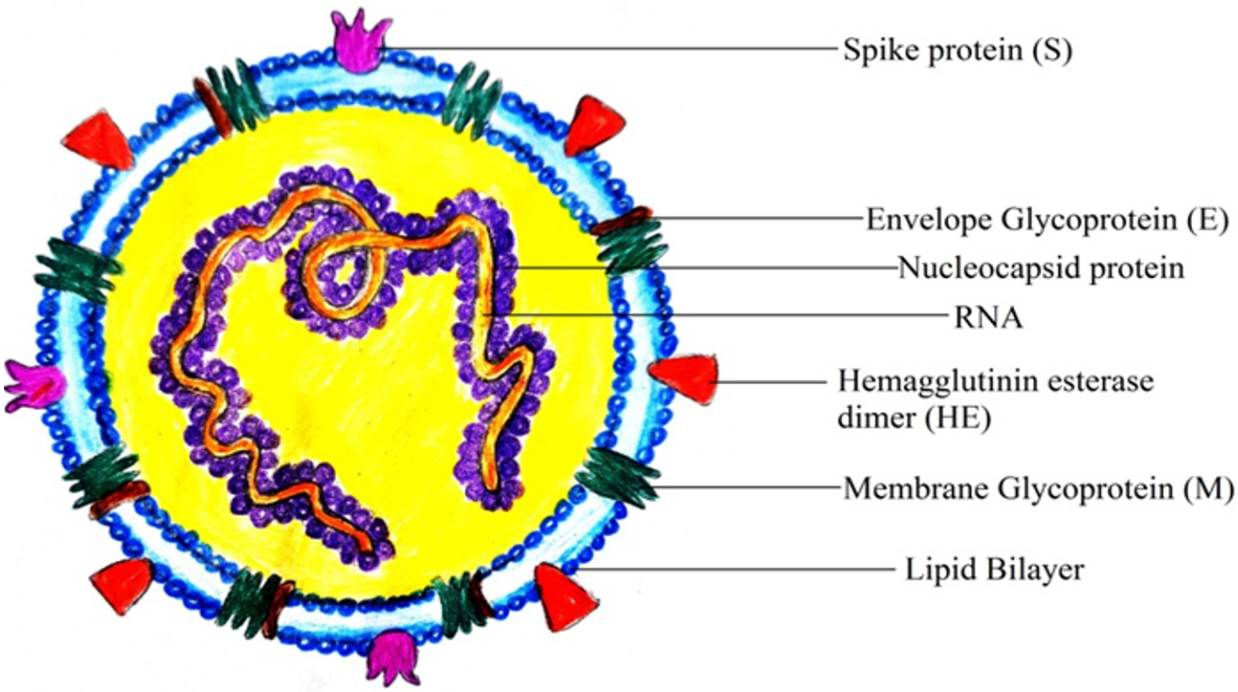

Figure 1: Structure of Coronavirus

Worldwide (mainly Middle east, North Africa, Eastern Europe, Russia, USA)

Disease

Causative agent is *Vibrio cholerae*

Death

800,000+ worldwide (in India around 700,000) (Staff, n.d.)

Spanish Flu pandemic

Period

1918-1920

Origin

Kansas, USA

Location of spread

Worldwide

Disease

Influenza , caused by H1N1 Virus

Infected

About 500 million

Death

Over 50 million (world population in 1918 was 1.8 billion). Some 12-17 million people died in India which was about 5% of total population. China was less affected in comparison to India - 5 to 9 million cases.

This was one of the deadliest flu outbreaks in history. (Duda and H1N1, 2020)

Asian Flu pandemic

Period

1956 - 1958

Origin

Guizhou, China

Location

China, Singapore, Hong Kong, USA

Disease

Influenza A virus type H2N2

Death

Over 2 million (69,800 in USA alone) (Staff, n.d.)

Hong Kong Flu pandemic

Period

1968 - 1969

Origin

Hong Kong, China

Location of spread

Singapore, Vietnam, The Philippines, India, Australia, Europe, USA

Disease

Influenza A virus subtype H3N2 (a genetic derivative of H2N2 Subtype)

Death

More than a million (5,00,000 in Hong Kong) (Staff, n.d.)

Swine Flu pandemic

Period

January 2009 - August 2010

Origin

Mexico, North America

Location of spread

Worldwide

Disease

Influenza Pandemic H1N1/09 Virus

Infected

700 million - 1.4 billion

Death

575,000 (in India 2728 people) (Collignon, 2011)

HIV/AIDS pandemic

Period

1981-2012

Origin

Democratic Republic of Congo (transmitted from chimpanzee to human) Virus was identified in 1980 & since then 75 million people were affected.

Location

Worldwide, largely affecting African Continent

Disease

Caused by Human Immunodeficiency Virus (HIV)

Infection

65 million infected

Death

Killed more than 25 million people since 1981. In 1997-1998 there were 2.75 million HIV/AIDS affected people in India. In 2005 itself, death toll due to AIDS was approximately 2.8 million population. In India in 2006-2008 - there were 150000 people affected. Global death dropped to 1.6 million in 2012. In 2015 there were 2.11 million people affected with HIV/AIDS. In 2016 , there were 60000 people affected. Thus, there was an overall reduction of cases by 57%. By the end 2018, an estimated 37.9 million people were affected with HIV around the world. (Sharp and Hahn, 2011; CDC, 2006)

WHY COVID-19 HAS BEEN DECLARED AS PANDEMIC?

Severe acute respiratory syndrome corona virus 2 (SARS-CoV 2) or the 2019 novel coronavirus (2019-nCoV)as it is currently referred to as, had a rapid spread from its place of origin -Wuhan City of Hubei Province, China to all other countries around the world. Approximately 96,000 cases got affected by coronavirus disease 2019 (COVID-19). Approximately 3300 fatal cases had been documented by 5th March 2020. It was observed that children had been less commonly affected with no fatal cases. But we are yet uncertain about the upcoming events related to COVID-19 (Singhal, 2020).

On 11th March 2020, World Health Organization took out the census that the total cases of COVID-19 outside China got amplified by 13 times, and the number of affected countries got increased by 3 times. They claimed that the total cases are more than 118,000 in 114 countries and the death toll is 4,291 worldwide. Approximately more than thousands were fighting for their lives in hospitals (WHO, 2020b). And they also announced that in the upcoming days, it was expected that the total cases, death toll & the total affected countries would rise in number. WHO had been monitoring the outbreak 24x7 & they were worried about both the increasing rate of spread and severity, and the increasing rate of negligence. They, thus formulated an estimation that COVID-19 can be categorized as a pandemic (WHO, 2020b). On 14th April 2020, there were in total 1,925,571 coronavirus affected cases worldwide, with a death count of 119,718 and a total of 452,188 recovered cases (Coronavirus Update, 2020).

OVERVIEW OF THE VIRUS

Coronavirus - Shape and Structure

Coronaviruses belong to the order Nidovirales and family Coronaviridae. "Corona" means "crown-like" spikes present on external surface of the virus; therefore, it was named as "Coronavirus". Diametrically, it is of size 65-125nm. Has nucleic material made of a single-stranded RNA whose size range from 26 to 32kbs in length enveloped in membrane glycoprotein (Figure 1). The 4 subgroups of coronaviruses family are alpha (α), beta (β), gamma (γ) and delta (δ) coronavirus (Shereen *et al.*, 2020).

Some severe respiratory diseases like acute lung injury and acute respiratory distress syndrome

(ARDS) are caused by viruses like SARS-CoV, H5N1 influenza A, H1N1 2009 and Middle East respiratory syndrome coronavirus (MERS-CoV). This cause failure of the pulmonary system which ultimately lead to death. Earlier these viruses were known to cause infections in animals only. In 2002 this concept changed when there was an outbreak of severe acute respiratory syndrome (SARS) by SARS-CoV, in Guangdong, China. Almost 10 years later, one more pathogenic coronavirus, i.e., MERS-CoV led to an endemic in Middle Eastern countries (Shereen *et al.*, 2020).

Origin and Spread of COVID-19

COVID-19 has its origin in Wuhan which is the capital city of Hubei province. It is one of the chief shipping hubs of China. In December 2019, it was seen that the middle-aged population of that area reported with symptoms of severe pneumonia of unknown cause to local hospitals. Most of the cases of that area went through a common exposure to Huanan wholesale seafood market. This market is known to trade live animals and wildlife products too (Singhal, 2020). Following SARS outbreak, the respiratory samples of the affected cases were given for etiologic investigations and a highly active surveillance system was put to action to detect and identify the new cases. On 31st December 2019, China reported this SARS outbreak to the WHO. On 01/01/20 the Huanan sea food market had been shut down completely. And after various investigations, finally on 07/01/2020 this virus came to be recognized as a coronavirus. It was >95% similar to the bat coronavirus and > 70% similar to SARSCoV. Specimens were collected from different locations of Huanan sea food market which gave a positive result for the same virus implying that the virus has its origin from that place (Singhal, 2020).

Over the period of time the number of cases started rising exponentially. Among them there were cases who had no direct exposure to the Huanan market signifying that spread of infection is possible from one human to another. The 1st death due to coronavirus was reported on 11th January 2020. Intensification of the epidemic occurred mainly during the event of Chinese New Year when a massive migration of the Chinese population was seen. Cases were also reported, from various regions of China and countries like Thailand, Japan and South Korea, in people who had a history of travelling to Wuhan in the recent past. Cases in these areas increased in quick succession. On 20th January 2020 transmission to healthcare workers who took care of these patients was reported. On 23rd January 2020, 11 million people of Wuhan were locked down and the borders of the entire city were sealed to restrict entry or departure from that area. These measures were put forth in other cities of Hubei province as well. Soon enough there were COVID-19 cases reported in patients in different countries with no travel history to China. This further confirmed the local human-to-human transmission. People returning from China were strictly screened in International Airports of different countries for symptoms and the ones who were symptomatic were isolated and tested for COVID-19. But later on the fact became quite clear that there can be a transmission of infection from asymptomatic patients too, much before the arrival of the first symptom. Thus, those countries (India included), who brought back their natives from Wuhan or had people who had travelled from China in the recent past, had put all of them under quarantine for 14 days and performed tests on them for the virus.

There was an exponential rise in the number of cases & analytical studies showed an epidemic doubling time of 1.8 days. On 12/02/2020, China modified the definition of "Confirmed Cases" to incorporate patients who gave negative results as well as those that have results awaiting for molecular tests but clinically, radio-graphically and epidemiologically has features of COVID-19. This amplified the cases by 15,000 in one day. On 5th March 2020, approximately 96,000 cases around the world had turned up which included 80,000 cases from China, and the rest from 87 countries and one international transport (696 were from the cruise ship called Diamond Princess which was parked off the coast of Japan). Although over the period of time the incidence of coronavirus cases has decreased in China, there had been an exponential add up in the number of new patients in countries like South Korea, Italy and Iran. On 08th April 2020, there were total 1,468,776 coronavirus cases worldwide (81,802 cases in China and USA leading with 400,549 cases), India had total of 5,360 cases. Among the ones who had acquired the infection, 5% were under critical condition, 79% had shown recovery, and 85,442 had died (i.e., 21%) (Coronavirus, 2020)

Initially in India, i.e., on 2nd March 2020, only 3 cases were reported. Soon thereafter, there was a sudden outburst in the number of cases. By 5th March 2020, a total of 29 patients turned up. They were from Delhi, Jaipur & Agra. By the third week of March 2020 the number of COVID-19 positive cases went above 300. Keeping this scenario in mind, on 22nd March 2020, a 14-hour long Janta Curfew was announced by the Prime Minister of India. This was followed by announcement of complete lockdown of India on 24th March 2020 for 21 days. This was

imposed on all the states of India (included each district, each lane and each village of India) (Gettleman and Schultz, 2020). On 08/04/2020, Indian Ministry of Health and Family Welfare (MOHFW) reported a total of 4,643 active cases with a total death toll of 149 due to COVID-19. On 10th April 2020, as per MOHFW, India has a total of 6,565 active cases, a total of 239 deaths and 642 recovered cases and states with most cases so far were Maharashtra (1574), Tamil Nadu(911), Delhi (903), Rajasthan (561) and Telangana(487). On 14th April 2020, India had total of 10, 453 cases with a death toll of 358, which led to the announcement of the lockdown extension by another 21 days to check the accelerated spread of virus.

EPIDEMIOLOGY AND PATHOGENESIS

People of all ages have shown susceptibility. Mode of transmission is via big droplets expelled out by symptomatic patients while they cough or sneeze. It can also spread from asymptomatic patient & much before arrival of symptom (Rothe *et al.*, 2020). The virus burden is same in both symptomatic and asymptomatic individuals with a greater virus quantity found in nasal cavity as compared to the throat. The spread and deposition of infected droplets can be up to a distance of 1-2 metres. The surface on which these droplets gets deposited can sustain the virus as long as there is favourable atmospheric conditions for up to 9 days. Agents that can destroy the virus are 0.1% sodium hypochlorite, 71% ethanol or hydrogen peroxide etc (Kampf *et al.*, 2020). Humans acquire the infection when they come in contact with such surfaces and then touch their nose, mouth and eyes (Singhal, 2020).

STAGES OF TRANSMISSION

Talking of transmission of infection in humans, the word "transmission" means "the spread of microorganisms from one infected individual to another uninfected individual, either through direct contact, through droplets, or through indirect contact such as surface contamination".

The SARS-CoV 2 have 4 stages of transmission — which is in accordance with other infectious diseases (Covid-19 transmission, 2020).

Stage 1

"The first appearance of the disease through people with a travel history, with everyone contained, their sources traced, and no local spread from those affected". In this stage, total number of cases who has the infection is small.

Stage 2

"Local transmission, when those who were infected and have a travel history spread the virus to close friends or family". Here, we are able to track all those who were in contact with the infected patient so that we can put them in isolation.

Stage 3

Community transmission, when infections happen in public and a source for the virus cannot be traced". Here, a big geographic area is locked down because any random person from the community can acquire the infection.

Stage 4

"When the disease actually becomes an epidemic in a country with large numbers of infections and a growing number of deaths with no end in sight". This was seen in case of China. It is now considered as endemic to that region and its prevalence is established in that region.

One of the latest community occasion via which the spread had taken place had been the "Tablighi Jamaat Congregation" in Delhi, held in mid-March 2020. The total cases of infection from this congregation is approximately more than 600, which had spread to 14 states in only 2days. From then onwards, the system continued aggressive tracing of those who attended the congregation or got in touch with attendees. Most regions saw a rise in the number of cases, and a cluster containment policy was made for big regional outbreaks. The different Covid-19 hotspots was recognized, disease surveillance was done, every suspected case — as well as SARI — was tested. In addition to this, healthcare amenities were given and location-wise quarantine was put into force having strict perimeter control. There was a "quarantine zone", bordered by a "buffer zone" to restrict further transmission (Covid-19 transmission, 2020).

COMMUNITY MITIGATION STRATEGIES IN TIMES OF COVID-19 PANDEMIC

The numbers of cases that are reported are far less than the actual number. This is mainly due to 3 reasons,

1. Shortage or unavailability of testing kits
2. Basic reproductive value (R_0) is 2.2
3. Viral shedding occurring from infectious asymptomatic people

Basic reproduction number (R_0)

"The reproduction number when there is no immunity from past exposures or vaccination, nor any

deliberate intervention in disease transmission. We refer to *R* as an effective reproduction number when there is some immunity or some intervention measures are in place" (The Reproduction Number, 2006). Countries are taking strict measures like travel suspension, restriction of any sort of gathering. Exporting of medical products has also been suspended from countries which are severely affected by this pandemic. Our main aim thus remains as the mitigation of the accelerated spread of COVID-19 (Ebrahim *et al.*, 2020).

Key community mitigation strategies

1. Any kinds of events or social gatherings must be cancelled as they have the potential to spread infections.
2. Reducing direct or close contact with community people by implementing social distancing measures.
3. Travelling should be avoided to avoid usage of public transport, flights. Routes should allow only essential services.
4. People should voluntarily go in home quarantine.
5. Crowd size at funeral services should be kept minimal to avoid contact with the diseased.
6. National and International health authorities should provide updated information at regular interval so that only verified information reaches the common public and not fake news or rumours.

These steps will help to reduce this accelerated outbreak of this pandemic. To maintain a calm & compliant response from people to mitigation guidelines, elements of transparency and trust are of utmost importance. Public gatherings and occasions like festivals, religious congregations, cultural events, conferences, & political gatherings must be prohibited. Spread of respiratory infections are commonly seen in these gatherings. Although the R0 value is very less in such cases, it is the crowd density in these public gatherings which leads to higher transmission rates. The Umrah pilgrimage which happens throughout the year in Saudi Arabia was cancelled on 27th February 2020. This decreased the transmission of COVID-19 in Saudi Arabia. On the contrary, the Qom pilgrimage of Iran was not suspended which led to huge geographical outbreak of the infection in that area. Even the Summer Olympics 2020 which was to be held in Tokyo got rescheduled to 2021. Social distancing measures were adopted which reduced the frequency and duration of social contacts with public, thus reducing the spread of virus. Schools, colleges & universities, childcare institutions, religious spots, entertainment places, and rest of the venues with possible mass gatherings were all shut down. These places are the potential spots for respiratory disease transmission. Modified work schedules and roster duty plans were formulated to reduce disease spread. Telemedicine, video conferencing, telecommuting, and prolonged leave schemes was designed to help workers follow the social distancing policies (Ebrahim *et al.*, 2020).

Travelling plays a very important role in disease transmission. So, any kind of travelling or movement should be completely restricted unless it is absolutely necessary like timely arrival of supplies, etc. Home delivery facilities should be made available. Restrictions of transport facilities like flights, trains and other routes should be implemented. Also community sensitisation for the same should be done. The concept of "Voluntary home quarantine" should be encouraged to reduce pressure on emergency healthcare system. In such situations, even though there are high chances of spread of infections within the family, the total affected case will be far less than that in institutional settings. Tele-health facilities can be made available for the ones under home quarantine. Telemedicine and Telepsychiatry facilities should be made available. This will not only help in diagnosing the patients and prescribing them medications, but will also provide therapies such as cognitive behavioural therapy, family therapy and supportive therapy (Behere *et al.*, 2017b). Quarantine or self isolation can induce mental health problems like stress, anxiety and depression. Therefore, tele-health facilities will help counteract such problems and provide timely aid to the ones who need, thus enabling them to lead a healthy life (Behere *et al.*, 2017a).

Gatherings at home funerals should be avoided in such situations as this was one of the main reasons for uncontrolled Ebola outbreak in some countries in the past. New funeral rules should be introduced to prevent crowd and the virus spread through body fluids. These early risk prevention strategies aid in the transmission of infection in community. According to a recent in-vitro study, it is seen that remdesivir (a new antiviral drug) and chloroquine (an old antimalarial drug) inhibits the growth of SARS-CoV-2. *Also it is seen that* Hydroxychloroquine clinical safety profile is superior to chloroquine (when used for a longer duration) and it facilitates higher daily dose and has lesser concerns about drug-drug inter-

actions. Thus, it can effectively be given to patients who are diagnosed as mild, moderate and severe cases of COVID-19 pneumonia and are without any contraindications to chloroquine, dose being 500 mg chloroquine twice a day for ten days (Gautret *et al.*, 2020).

The National Task force for COVID-19 constituted by Indian Council of Medical Research recommends the usage of hydroxy-chloroquine for prophylaxis of SARS-CoV-2 infection for high risk population (Balram, 2020). Eligible individuals and their designated dosage are,

Asymptomatic healthcare workers involved in the care of suspected or confirmed cases of COVID-19

Dose

400mg twice a day on Day 1, followed by 400mg once weekly for next 7 weeks; to be taken with meal (Balram, 2020).

Asymptomatic household contacts of laboratory confirmed cases

Dose

400mg twice a day on Day 1, followed by 400mg once weekly for next 3 weeks; to be taken with meals (Balram, 2020).

CONCLUSION

So far there is no particular drug or vaccine present in the market which is specific to the treatment of this infection. Thus, there is over-burdening of the health care systems in all places. So, for now we must place our trust on targeted, non-coercive, community interventions. This should have adequate transparency & community involvement and trust. We must put them in to action immediately. This novel virus outbreak has challenged the infrastructure of economy, medicine and public health of almost all the countries. Also, future outbreaks of zoonotic viruses and pathogens are probable. So, besides counteracting this outbreak, we must also put our efforts in planning out comprehensive strategies to avoid any potential outbreaks of zoonotic origin.

Conflict of Interest

The authors declare that they have no conflict of interest for this study.

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