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**QUESTION:**

WRITE A COMPREHENSIVE REVIEW ON THE AETIOLOGY OF COVID-19, ITS PATHOGENESIS, HISTOPATHOLOGICAL FEATURES AND THE CURRENT POTENTIAL THERAPIES TO ADDRESS IT. ALSO COMMENT ON THE FUTURE OF COVID-19 ON PUBLIC HEALTH.

**WHAT IS CORONA VIRUS?**

According to WHO corona virus can be defined as a large family of viruses which may cause illness in animals or humans. In humans, several coronaviruses are known to cause respiratory infections ranging from the common cold to more severe disease such as middle east respiratory syndrome (MERS)and severe acute respiratory syndrome (SERS). The most recently discovered coronavirus causes COVID-19.

Corona virus is a type of virus. There are many different kinds, and some cause disease. A newly identified type has caused a recent outbreak of respiratory illness now called COVID-19. (Lauren m.,2020)

**WHAT IS COVID-19?**

According to WHO Covid-19 is the infectious disease caused by the most discovered coronavirus. This new virus and disease were unknown before the outbreak in wuhan, china, in December 2019.

COVID-19 appeared in wuhan, a city in china, in December 2019. Although health officials are still tracing the exact sources of this new coronavirus, early hypotheses thought it may be linked to a seafood market in wuhan, china. Some people who visited the market developed viral pneumonia caused by the new coronavirus. (Lauren m.,2020)

**COVID-19 AND SARS (SEVERE ACUTE RESPIRATORY SYNDROME) ARE NOT THE SAME!**

The virus that causes COVID-19 and the one that caused the outbreak of SARS in 2003 are related to each other genetically but the disease they cause are quite different. SARS was more deadly but much less infectious than COVID-19. There has been no outbreak of SARS anywhere in the world since 2003.

**AETIOLOGY OF COVID-19**

Aetiology can be defined has cause, set of causes, or manner of causation of a disease or conditions.

**HOW DOES COVID-19 SPREAD**

As of now, researchers know that the new coronavirus is spread through droplets released into the air when an infected person coughs or sneezes. The droplets generally do not travel more than a few feet, and they fall on the ground (or onto surfaces) in a few seconds-this is why social and physical distancing is effective in preventing the spread.

**WHAT IS THE INCUBATION PERIOD FOR COVID-19?**

It appears that symptoms are showing up in people within 2-14days of exposure to the virus

**WHAT ARE THE SYMPTOMS OF COVID-19?**

COVID-9 symptoms include:

* Cough
* Fever
* Shortness of breath
* Muscle aches
* Sore throat
* Unexplained loss of taste of smell
* Diarrhoea
* Headache

In rare cases, COVID-19 can lead to severe respiratory problems, kidney failure or death.

**HOW COVID-19 IS DIAGNOSED?**

Diagnosis may be difficult with only a physical exam because mild cases of COVID-19 may appear similar to the flu or a bad cold. A laboratory test to confirm the diagnosis.

**HOW IS COVID-19 TREATED**

As of now, there is not a specific treatment for the virus. People who become sick from COVID-19 should be treated with supportive measures: those that relieve symptoms. May be additional options for treatment, including research drugs and therapeutics

**HOW TO PROTECT YOURSELF FROM THIS CORONAVIRUS?**

It’s crucial to practice good hygiene, respiratory etiquette and social and physical distancing. The effective way to protect yourself and others against COVID-19 are too frequently clean your hands, cover your cough with bend elbow or tissue, maintain a 1 metre (3feet) from people who are coughing or sneezing.

**PATHOGENESIS OF COVID-19**

Coronaviruses cause respiratory and intestinal infections in animals and humans. They were not considered to be highly pathogenic to humans until the outbreak of severe acute respiratory syndrome (SARS) in 2002 and 2003 in Guangdong province, China, as the coronaviruses that circulated before that time in humans mostly caused mild infections in immunocompetent people. Ten years after SARS, another highly pathogenic coronavirus, Middle East respiratory syndrome coronavirus (MERS- CoV) emerged in Middle Eastern countries. SARS coronavirus (SARS- CoV) uses angiotensin- converting enzyme 2 (ACE2) as a receptor and primarily infects ciliated bronchial epithelial cells and type II pneumocytes, whereas MERS- CoV uses dipeptidyl peptidase 4 (DPP4; also known as CD26) as a receptor and infects unciliated bronchial epithelial cells and type II pneumocytes. SARS- CoV and MERS- CoV were transmitted directly to humans from market civets and dromedary camels,

respectively, and both viruses are thought to have originated in bats. Extensive studies of these two important coronaviruses have not only led to a better understanding of coronavirus biology but have also been driving coronavirus discovery in bats globally. In this Review, we focus on the origin and evolution of SARS- CoV and MERS-C oV. Specifically, we emphasize the ecological distribution, genetic diversity, interspecies transmission and potential for pathogenesis of SARS- related coronaviruses (SARSr-C oVs) and MERS-related coronaviruses (MERSr- CoVs) found in bats, as this information can help prepare countermeasures against future spillover and pathogenic infections in humans with novel coronaviruses.

**Coronavirus diversity**

Coronaviruses are members of the subfamily *Coronavirinae* in the family *Coronaviridae* and the order *Nidovirales* (International Committee on Taxonomy of Viruses). This subfamily consists of four genera — *Alphacoronavirus*, *Betacoronavirus*, *Gammacoronavirus* and *Deltacoronavirus* — on the basis of their phylogenetic relationships and genomic structures. The alphacoronaviruses and betacoronaviruses infect only mammals. The gammacoronaviruses and deltacoronaviruses infect birds, but some of them can also infect mammals. Alphacoronaviruses and betacoronaviruses usually cause respiratory illness in humans and gastroenteritis in animals. The two highly pathogenic viruses, SARS- CoV and MERS- CoV, cause severe respiratory syndrome in humans, and the other four human coronaviruses (HCoV-N L63, HCoV-229E, HCoV-OC43 and HKU1) induce only mild upper respiratory diseases in immunocompetent hosts, although some of them can cause severe infections in infants, young children and elderly individuals. Alphacoronaviruses and betacoronaviruses can pose a heavy disease burden on livestock; these viruses include porcine transmissible gastroenteritis virus, porcine enteric diarrhoea virus (PEDV) and the recently emerged swine acute diarrhoea syndrome coronavirus (SADS- CoV). On the basis of current sequence databases, all human coronaviruses have animal origins: SARS- CoV, MERS- CoV, HCoV- NL63 and HCoV-229E are considered to have originated in bats; HCoV- OC43 and HKU1 likely originated from rodents. Domestic animals may have important roles as intermediate hosts that enable virus transmission from natural hosts to humans. In addition, domestic animals themselves can suffer disease caused by bat- borne or closely related coronaviruses: genomic sequences highly similar to PEDV were detected in bats, and SADS- CoV is a recent spillover from bats to pigs. Currently, 7 of 11 assigned *Alphacoronavirus* species and 4 of 9 *Betacoronavirus* species were identified only in bats.

**Variability of SARS- CoV in humans and civets** The genome sequences of SARS-C oVs from market civets are almost identical to the genomes of human SARS- CoVs. However, two genes show major variation. The first variable region is located in the *S* gene. The SARS- CoV S protein is functionally divided into two subunits, denoted S1 and S2, which are responsible for receptor binding and fusion with the cellular membrane, respectively. S1 is further divided into the amino- terminal domain (S1-NTD) and the carboxy- terminal domain (S1-CTD). The S1-CTD functions as the RBD and is responsible for binding ACE2 and entering cells. Two amino acid residues in the RBD, 479 and 487, were identified to be essential for ACE2-mediated SARS-C oV infection and critical for virus transmission from civets to humans.

The second major location of variation is the accessory gene *orf8*. On the basis of SARS spread, the SARS 2002–2003 outbreak could be divided into three phases, with the early phase characterized by a limited number of localized cases, followed by a middle phase during which a superspreader event occurred in a hospital and finally the late phase of international spread. The viral genomes from early- phase patients contain two genotypes of *orf8*, one with a complete *orf8* (369 nucleot ides) and the other containing an 82-nucleotide deletion. By contrast, viral genomes from late-p hase patients and most of the genomes from middle- phase patients contain a split *orf8*

 **Animal origins of human coronaviruses.**

 Severe acute respiratory syndrome coronavirus (SARS-C oV) is a new coronavirus that emerged through recombination of bat SARS-r elated coronaviruses (SARSr- CoVs). The recombined virus infected civets and humans and adapted to these hosts before causing the SARS epidemic. Middle East respiratory syndrome coronavirus (MERS-C oV) likely spilled over from bats to dromedary camels at least 30 years ago and since then has been prevalent in dromedary camels. HCoV-229E and HCoV-N L63 usually cause mild infections in immunocompetent humans. Progenitors of these viruses have recently been found in African bats, and the camelids are likely intermediate hosts of HCoV-229E. HCoV- OC43 and HKU1, both of which are also mostly harmless in humans, likely originated in rodents. Recently, swine acute diarrhoea syndrome (SADS) emerged in piglets. This disease is caused by a novel strain of *Rhinolophus* bat coronavirus HKU2, named SADS coronavirus (SADS-C oV); there is no evidence of stress, apoptosis and inhibiting interferon responses in host cells. Whetherand how these adaptations were involved in SARS-CoV virulence are not fully clarified.

**Receptor recognition by SARS- CoV and MERS- CoV.**

 Severe acute respiratory syndrome coronavirus (SARS- CoV) uses its receptor- binding domain (RBD) (as shown in the structure of strain hTor02, containing core structure (cyan) and receptor-binding motif (RBM; magenta)) to bind human angiotensin- converting enzyme 2 (ACE2; green; Protein Data Bank ID: 2AJF). ACE2 is a peptidase with zinc (blue) in its active centre. **b** | Several residues in the host and viral receptor, as well as two salt bridges that stabilize the structure (dotted lines) and form two binding hot spots, are crucial for binding of the severe acute respiratory syndrome (SARS) epidemic strain hTor02. Hydrophobic residues surrounding the two salt bridges are present in the structure. By contrast, the SARS- related coronavirus (SARSr- CoV) strain bWIV1, which was isolated from bats and can infect both civet and human cells, differs in residues. The mutation from threonine to asparagine in residue 487 introduces a polar side chain and is predicted to interfere with binding at hot spot. The model shown here was built on the basis of the structure of hTor02 RBD complexed with human ACE2 (Protein Data Bank ID: 2AJF), in which residues were mutated from those in strain hTor02 to those in strain bWIV1. The bat SARSr- CoV strain bRsSHC014 can also infect human and civet cells; it carries an alanine in position, and the short side chain of this residue does not support the structure of hot spot 353. The model was built on the basis of the structure of cOptimize RBD complexed with human ACE2 (Protein Data Bank ID: 3SCJ), in which residues were mutated from those in strain cOptimize to those in strain bWIV. The Middle East respiratory syndrome coronavirus (MERS-C oV) RBD (core structure in cyan and RBM in magenta) binds human dipeptidyl peptidase 4 (DPP4; green; Protein Data Bank ID: 4KR0). Structure figures were made using PyMOL. Modelled mutations in panels **c** and **d** were performed using Coot.

**Origin and evolution of MERS-C oV**

Whereas the emergence of SARS involved palm civets, most of the early MERS index cases had contact with dromedary camels. Indeed, MERS- CoV strains isolated from camels were almost identical to those isolated from humans. Moreover, MERS-C oV-specific antibodies were highly prevalent in camels from the Middle East, Africa and Asia. MERS-C oV infections were detected in camel serum samples collected in

1983 (rEF.), suggesting that MERS- CoV was present in camels at least 30 years ago. Genomic sequence analysis indicated that MERS- CoV, *Tylonycteris* bat coronavirus HKU4 and *Pipistrellus* bat coronavirus HKU5 are phylogenetically related (denoted as betacoronavirus lineage C). The viruses in this lineage have identical genomic structures and are highly conserved in their polyp roteins and most structural proteins, but their S proteins and accessory proteins are highly variable. MERSr- CoVs were found in at least 14 bat species from two bat families, Vespertilionidae and Nycteridae. However, none of these MERSr-C oVs is a direct progenitor of MERS-C oV, as their S proteins differ substantially from that of MERS-C oV.

To understand the evolutionary relationships between MERS-C oV and MERSr-CoVs, we constructed a phylogenetic tree on the basis of the alignment of all the coding regions Supplementary truncated ORF4b gene replicate less efficiently in human cell culture and are less pathogenic in human DPP4 transgenic mice. Curiously, deletion of the *orf4* gene in the human MERS-C oV strain EMC did not substantially reduce virus replication, although it induced a stronger interferon response. Another study demonstrated that the deletion of *orf3–orf5* dramatically attenuated MERS- CoV virulence, primarily through increased host responses, including disrupted cellular processes, increased activation of the interferon pathway and robust inflammation.

**FUTURE OF COVID-19 ON PUBLIC HEALTH**

A sudden outbreak of coronavirus disease 2019 (COVID-19) caused by infection with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus has happened since December 2019 in Wuhan City, Hubei Province, a central city in the People’s Republic of China, where transportation is enormously convenient to connecting all other places in China and overseas. As of 7 March, 2020, a total of 80 813 confirmed cases reported in all provinces of China, and 21 110 cases reported in 93 countries/territories/areas of six continents]. In particular, some cases have been confirmed in African countries, such as Algeria, Egypt, and Nigeria. This is the biggest infectious disease outbreak in China ever since 1949, the year of founding the People’s Republic of China. It is the biggest battle since the disease is spreading so fast with high prevalence, and the prevention of the transmission has involved all people in the country. While at global level, the strategy and coordinating mechanism to control COVID-19 need to be set down as soon as possible, in particular, three questions need to be addressed as

* how to take the emergency response actions effectively in different countries?
* how to mobilize resources quickly with strategic ways? And
* how to encourage people proactively and orderly to participate in this battle against COVID-19 from different regions of the world?

# **Lessons from the battle against COVID-19 in China**

In order to address three aforementioned questions, the lessons from China in the battle against COVID-19 need to be understood clearly in the following three aspects:

Traditional epidemiological approaches effectively control the transmission

Professionally speaking, three steps are necessary to taken once an infectious disease outbreak in certain regions, including controlling infectious sources, blocking the transmission routes, and protecting the susceptive population. While, as COVID-19 spreading so fast and people’s travelling so frequent during the Chinese New Year (Spring Festival) season, it cannot control effectively if only taking the normal or general countermeasures. Therefore, the Chinese government has quickly taken actions to contain its transmission inside China, including detecting the disease early, diagnosis and reporting early, isolating and treatment of cases early, tracing all possible contacts, persuading people to stay at home, and promoting social distancing measures commensurate with the risk, etc., based on the current knowledge about epidemiological features and transmission patterns of COVID-19.

Response strategies coping with local conditions In dealing with the outbreak, China has been adopting the way of tailoring interventions into local settings, from quickly finding each infected person, tracing close contacts and placing them under quarantine, to promoting basic hygiene measures to the public, such as frequent hand washing, cancelling public gathering, closing schools, extending the Spring Festival holiday, delaying return to work, and to the most severe measure of city lockdown of Wuhan. By adapting response strategies to the local context, it may avoid blockading the city when it is not needed, and also prevent from a major outbreak without taking any action.

Mobilizing resources quickly to support the emergency responses

Under the strong leadership of the Central Government of China, the mobilization for the emergency responses has been effectively promoted in following ways. Firstly, a Joint Prevention and Control Mechanism of the State Council has established involving 32 Ministries, with subgroups on control of outbreak, medical rescue, scientific research, information and communication, international cooperation, logistics, and frontline coordination. This multi-sectoral cooperation mechanism at high level is to ensure the facilities and supplies have been well arranged to support the emergency responses in all provinces, with focus on the Hubei Province, for example, more than 10 mobile hospitals and two big hospitals with each one having the capacity of holding more than 1000 beds have been built within 10 days. Secondly, more than 40 000 medical professionals from other provinces or military institutions have been dispatched to Hubei Province to implement emergency responses, including medical care and treatment, epidemiological investigations, environmental sterilization for disinfection, and data and information management to support the policy making.

Encouraging people proactively and orderly participate in this battle against COVID-19

It is important to protect the community from exposure to the infection, all residents in the potential risk areas were encouraged to stay at home, which is an effective way to block the transmission routes. Local community health workers and volunteers, after the specific training, proactively participate in screening the suspicious infections, and help in implementing proper quarantine measures by providing support services, such as driving patients to the mobile hospitals. All those activities logistically managed at the community level.

At the same time, from medical care side, the medical doctors and nurses worked very hard in the hospitals, to screen the suspected cases, provide medical care for the confirmed cases, and taking emergency response to rescue severe patients to reduce the fatality. While epidemiologists working in centres for disease control and preventions provided the statistical results for the dissemination of epidemiological data correctly, and provide the well-prepared datasets for the decision makers for coordination of necessary resources, and many health workers investigate the suspected contactors for quick medical quarantine of the suspected cases at the community level.

**Preventing the pandemic of COVID-19**

With the conceptualization on building a community with a shared future for mankind proposed by Chinese President Xi Jinping in 2013, Chinese people have taken following actions to prevent the pandemic of the diseases:

1. sharing the sequences of SARS-Cov-2 virus with the World Health Organization (WHO) and other countries which are important information for other countries to prepare the tests for screening and diagnosis,
2. all epidemiological data with clinical treatment in China has been published in the international journals,
3. prevent spreading of the disease by traveling ban in Wuhan,
4. medical quarantine has been performed for all suspected contactors,
5. body temperature measuring facilities were equipped in all railway stations and airports, etc. In order to take very strict, contain measures for COVID-19 outbreak tailored to local settings, the travelling ban was executed in Wuhan, and encouraging no gathering and less travelling in other cities out of Hubei Province. Those actions were implemented by strong coordinating of the Chinese government in cooperation with local residents. To date, the epidemiological data has showed more than thousands of people have been protected from the infections, and increasing pattern of the transmission has been suppressed significantly in China.

**Challenges in fighting against COVID-19**

The fighting against COVID-19 has been lasting almost two months, and the time left for people outside of China to prepare the countermeasures has been narrowed quickly. To date, we have found it is one of the greatest challenges to human beings in fighting against COVID-19 in the history, since the pathogen of SARSCoV-2 is a new coronavirus, differed from either SARSCoV or MERS-CoV in terms of biological characteristics and transmissibility.

Technically, we have little knowledge on the pathogen and pathogenesis, without specific effectively drugs or vaccine against the virus infection, which cause difficulties in rescuing the severe cases which account for about 20% of the infections. The transmission routes are not clear enough, although we currently understand that the respiratory transmission from human to human is the major transmission route, but other ways for transmission, such as gastrointenstinal transmission or aerosol propagation, is not so clear.

Administratively, implementing the locked down measures in such a big city with over 15 millions of people is not an easy task, with a lot of preparing works from different dimensions of municipal logistic management, to support the emergency response actions. Thus, the multiadministrative systems need to be coordinated collectively, guiding from the central government, with more resources gathering from various places all over the country.

Globally, the information sharing is so important, including patients’ information sharing to trace the suspected cases to protect more people as quickly as possible, genome sequences information sharing to prepare the diagnostics as quickly as possible, and treatment schemes sharing to rescue more severe cases. The WHO declared the Public Health Emergency of International Concern based on the International Health Regulation (2005) in the early time of the outbreak of COVID-19, as it is an extraordinary event to constitute a public health risk to the states through the international spread of disease, and to potentially require a coordinate international response. All actions to strengthen surveillance and response systems on infectious diseases need to put emphasis on resources limited countries, such as Southeast Asia and African countries.

**Recommendations**

With understanding more about the nature of COVID19, it is necessary to understand clearly the current challenges against COVID-19 become increasing, not only to China but also to the world. In order to take quick actions to early prepare the battle against COVID-19 and better allocate enough health resources from the world, the recommendations are as follows:

**Coordinating interventions and resources mobilization globally**

Preparedness in low and middle income countries WHO has identified 13 African countries at the top-risk affected by COVID-19 but with limited resources against COVID-19, including Algeria, Angola, Cote d’Ivoire, the Democratic Republic of the Congo, Ethiopia, Ghana, Kenya, Mauritius, Nigeria, South Africa, Tanzania, Uganda and Zambia. These countries have direct links or greater numbers of people travelling to/from China. The preparing works on response to the imported cases need initiated as soon as possible with the assistance of WHO as well as developed world. The major preparing works are to prepare enough facilities for use in hospitals, such as test kits, facemasks, and personal protective equipment (PPE), to prepare the quarantine measures in each gate of the traveling venues, and to prepare information communication, etc. The emergency response mechanism on multi-sectoral cooperation needs to be established once the first case has been detected.

The fast spreading of COVID-19 to more than 90 countries/territories, with some cluster cases occurred in a few countries, demonstrated that this new disease has higher transmissibility compared with SARS and MERS. The nature of high transmissibility for COVID-19 requires us to (i) prepare the battle globally as soon as possible, by taking the advantage of the time window opened by Chinese battle against COVID-19, (ii) invest more weapons or tools against the diseases by better global coordination, and (iii) take proper quarantine measures globally. We are able to win the battle only if our actions are coordinated better at a global level.

**Resources mobilization globally**

One of lessons learnt from the battle in Wuhan is the speed of resources gathering against COVID-19 outbreak could not catch up the speed of the coronavirus spreading in early stage of the outbreak, and it is in need of support or assistances from outside of epicenter, including medical doctors, nurses, and facilities of PPE used in hospitals, and facemasks for residents. The strong support from outside of epicenter quickly to ensure all infectious sources either controlled through quarantine measures or treated in the specialized hospitals. Therefore, for those countries with weak health system, it is so urgent to get help from other parts of the world. WHO needs to mobilize its certified global emergency medical teams to get ready to be dispatched to other countries where health workers are in short supply while an outbreak occurs.

**Jointly fighting against common enemy ─ COVID-19**

As said by WHO Director-General in the news press on Public Health Emergency of International Concern declaration that “this declaration is not a vote of no confidence in China, our greatest concern is the potential for the virus to spread to countries with weaker health systems.” Therefore, international community needs to work together to prepare for the containment of COVID-19 transmission and spreading in other countries, under the scenario that more countries may be affected by the new coronavirus. These containment works have to quickly take readiness on active surveillance, early detection, isolation and case management, contact tracing and prevention of onward spread of COVID-19.

Therefore, at this stage, with more countries having confirmed more and more COVID-19 cases, all countries need work together on the following global actions on:

1. fighting against COVID-19 spreading, includingsharing the information of the disease transmission and epidemiological knowledge, sharing the experiences on case management and treatment approaches both for severe cases or light symptoms, and sharing new technologies or strategies to contain the transmission;
2. fighting against violating International HealthRegulation, by following the WHO’s authoritative advices which called on all countries to implement decisions that are evidence-based and convincing. We need to improve our quarantine measures to replace the disconnection of international traveling and trade restrictions, with an assistance of the improved active surveillance systems and AI-based technology to trace the contactors;

(iii)fighting against stigmatization, since the stigmatization is always present when the disease outbreak and people facing the sudden attack of this kind of epidemic. These phenomena on stigmatization may be at a scale of epicenter areas, or may be at a country and regional scale, and even at global scale. Thus, we need fight with the real and common enemy which is the new coronavirus, rather than the infected people. The international community needs the solidarity and sympathy to start the battle against the common enemy – the new coronavirus, as well as against stigmatization at the same time.

**Global cooperation in priority settings**

By considering COVID-19 is spreading so fast which causes difficulties in containing the disease, we, as a community of shared future for mankind, need better coordination in global cooperation and further improvement in the multi-sectoral cooperation in order to quickly take response and prevent from the pandemic [18]. In addition, we also need better coherence of our resources with more international partners, at least, we can quickly improve our priority settings in sharing information and data, on research priority settings, on surveillance and response to outbreaks at a global level.

**Cooperation on sharing information and data**

In order to quickly share the information and datasets for countermeasures, the actions on fast and open reporting of outbreak data and sharing of virus samples, genetic information, and research results are encouraged for all international communities, non-governmental organizations (NGOs), as well as governmental institutions around the world. Through regional and country office of WHO, more preventive information against COVID-19 can be disseminated to the public in the vulnerable countries.

**Coordination on surveillance and response**

With understanding the importance of human health in the planet, multi-sectoral and multi-lateral cooperation against COVID-19 pandemic are recommended at global level. Particularly, the scientific communities, governments and NGOs in different fields, such as public health, agriculture, ecology, epidemiology, governance planning, science, and many others need to collaboratively prevent future outbreaks, with better coordination. The secretary of the United Nations need take the responsibility to coordinate the actions on protecting the planetary health by systematic approaches, such as EcoHealth, One Health, Planetary Health and Urban Health, and making sure public resources are worthwhile investing in strengthening surveillance and response systems for preventing future outbreaks of emerging infectious diseases.

**Coherence on research priority settings**

We urgently encourage all governments and international foundation to support short-term and emergency response-related research projects to improve our understanding of the causes, risks, infectiousness, and threats of a pandemic. Health institutions at international level should be encouraged to organize the research priority settings on preventing the pandemic or averting the emergence of the disease. International conservation organizations start to take investigations on types of wildlife-pathogens interactions affecting human health. International environmental agencies can initiate researches on unsustainable transformations of natural environments and ecosystems that provide life supporting services for our health.

**Conclusions**

To summarize, COVID-19 is a new disease that has caused great impacts to the people’s daily life extraordinarily. We, as a community of shared future for mankind, need to take collectively and quickly strong emergency responses as a battle against our common enemy, the new coronavirus, not only in China but also in the world. All partners of international community and country leaders are encouraged to proactively take strategic actions as soon as possible to fight the COVID-19 together. Hard times will end finally, and we will meet each other in the blooming spring soon.

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