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Public Dissemination



Review on Research Progresses of COVID-19

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An unprecedented outbreak of pneumonia caused by a novel coronavirus (2019-nCoV) is now declared a pandemic (COVID-19) by the World Health Organization (WHO). Alongside the COVID-19 epidemic, the clinical research and scientific community respond with abundant timely peer-reviewed papers to help understand and characterize the virus and disease to fight against the epidemic. To sum up, the latest published papers mainly elaborate relevant studies on viral genome, pathogenic mechanisms, routes of transmission, clinical manifestations, epidemic characteristics, rapid development of diagnosis, treatment and prevention methods of COVID-19, and genomic data resources integration and mining.



Genome, Phylogenetic Analysis and Pathogenic Mechanism

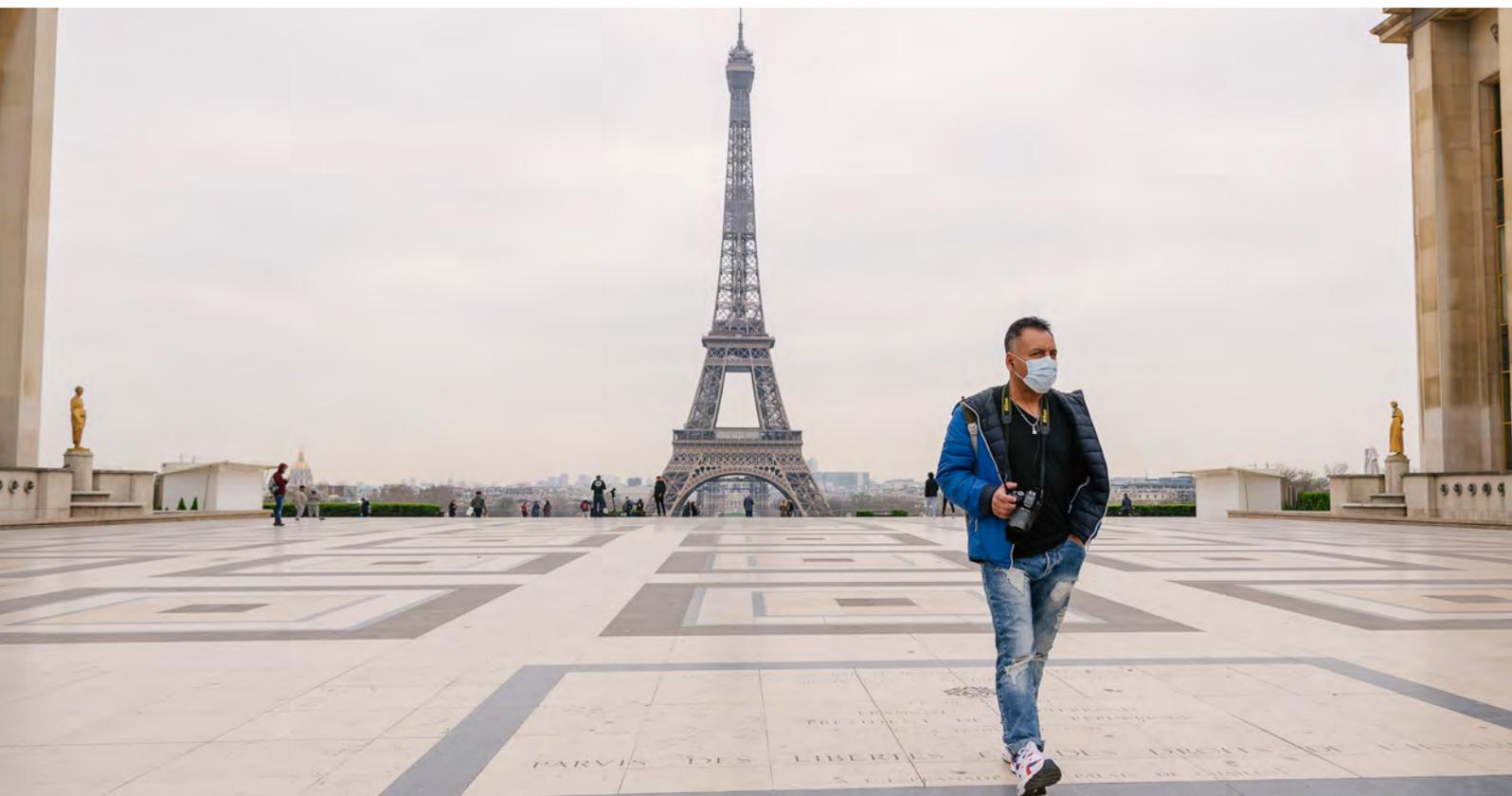
2019-nCoV is an enveloped virus with a positive-sense single-stranded RNA genome of about 30,000 nucleotides (Chan et al., 2020; Lu et al., 2020). Sequence alignments show that 2019-nCoV is ~80% identical to SARS-CoV (Severe Acute Respiratory Syndrome Coronavirus), while ~50% to MERS-CoV (Middle East Respiratory Syndrome Coronavirus). 2019-nCoV is closely related to bat-derived coronaviruses with over 96% sequence identity (Chan et al., 2020; Lu et al., 2020; Paraskevis et al., 2020; Zhou et al., 2020), while genome sequences of viral isolates obtained from COVID-19 patients exhibited 99.8–99.9% sequence identity (Lu et al., 2020; Ren et al., 2020).

Pathogenic mechanism studies on 2019-nCoV mainly involve the cellular receptor of angiotensin-converting enzyme 2 (ACE2), receptor-binding domain of virus spike proteins, the protease and potential cross-protective epitopes. The pathway of 2019-nCoV infection is confirmed as the respiratory and digestive systems. Lung epithelial cells are the primary target of 2019-nCoV (Gu & Korteweg, 2007). Like SARS-CoV, 2019-nCoV may also use ACE2 as an entry receptor in ACE2-expressing cells (Zhou et al., 2020). For both 2019-nCoV and SARS-CoV, the spike protein is a key protein to invade into host cells, and is an important target for antibody development (Qiu et al., 2020). In addition, detailed characterization of genome structure, analysis of specific viral gene, as well as protein structure modelling will provide more candidate targets for drug, vaccine and antibody design.

Transmission, Epidemiology and Clinical Manifestation

Transmission routes of 2019-nCoV are complicated. Person-to-person transmission is confirmed by infections occurred within familial clusters (Chan et al., 2020), which occurs primarily via direct contact or through respiratory droplets spread by coughing or sneezing (Wu et al., 2020; Zhu et al., 2020). Besides, fecal-oral transmission route is also considered because nucleic acids of 2019-nCoV could be detected in the stool samples of patients with abdominal symptom (Zhang et al., 2020). Vertical transmission from mothers to infants is another possible route since a newborn was confirmed with 2019-nCoV in Wuhan Children's Hospital. Transmission through the ocular surface should not be ignored because human conjunctival epithelium can be easily contaminated by infected droplets (Lu et al., 2020). Moreover, it is worth note that asymptomatic transmission was also found during the incubation period (Li et al., 2020).

Epidemiologically, 2019-nCoV is highly contagious with survival time of about 2 hours in the air (Han et al., 2020). The incubation period after infection is generally 0-14 days (Chen et al., 2020; Huang et al., 2020; Wang et al., 2020), with an average of 5.2 days (Li et al., 2020). All age groups are susceptible to 2019-nCoV, while most confirmed cases are mild, and the mortality rate is higher in the elder patients with chronic diseases (Chen et al., 2020; Huang et al., 2020; Wang et al., 2020). Clinical manifestations of COVID-19 mainly involve fever, fatigue, dry cough and myalgia, however, fever is not necessarily the first mani-



festation (Wang et al., 2020). Laboratory tests of patients at early stage indicate leukocytopenia, lymphopenia and mild elevated C-reactive protein (CRP). Besides, increase in the levels of leukocyte, granulocyte as well as D-dimer, creatine kinase and creatine were found in some severe cases (Paraskevis et al., 2020; Wang et al., 2020). Notably, some patients characterized as dyspnea and hypoxemia may rapidly progress to acute respiratory distress syndrome

(ARDS), septic shock, metabolic acidosis, coagulation dysfunction and even multiple organ dysfunction syndrome (MODS) (Paraskevis et al., 2020; Wang et al., 2020). Most patients suffered bilateral pneumonia are characterized with multiple patchy shadows, ground-glass opacity and interstitial infiltrations in chest computerized tomography (CT) (Huang et al., 2020; Paraskevis et al., 2020; Zhu et al., 2020).



Diagnosis, Treatment and Prevention

Diagnosis of COVID-19 is based on the epidemiological risks, clinical features and laboratory tests. Rapid and sensitive detection methods are essential for the identification, isolation and treatment of COVID-19 patients. Real-time RT-PCR are primary method for diagnosing 2019-nCoV among the many diagnostic platforms available. After the release of 2019-nCoV genome in China, specific and sensitive operating procedures by Real-time RT-PCR was proposed and recommended as laboratory diagnostic guidelines by WHO to monitor and detect 2019-nCoV infection globally (Drosten, 2020; WHO, 2020). The period and type of specimen collected for Real-time RT-PCR test are of great importance for accurate diagnosis. Positive test result by Real-time RT-PCR with specimens from the respiratory tract or serum indicates confirmed 2019-nCoV infection (Zhou et al., 2020). However, due to the possible false positive test results, the typical pulmonary imaging performance cannot be ignored, and even can be used as a preliminary screening method (Pang et al., 2020).

Since the outbreak of COVID-19, several therapeutic

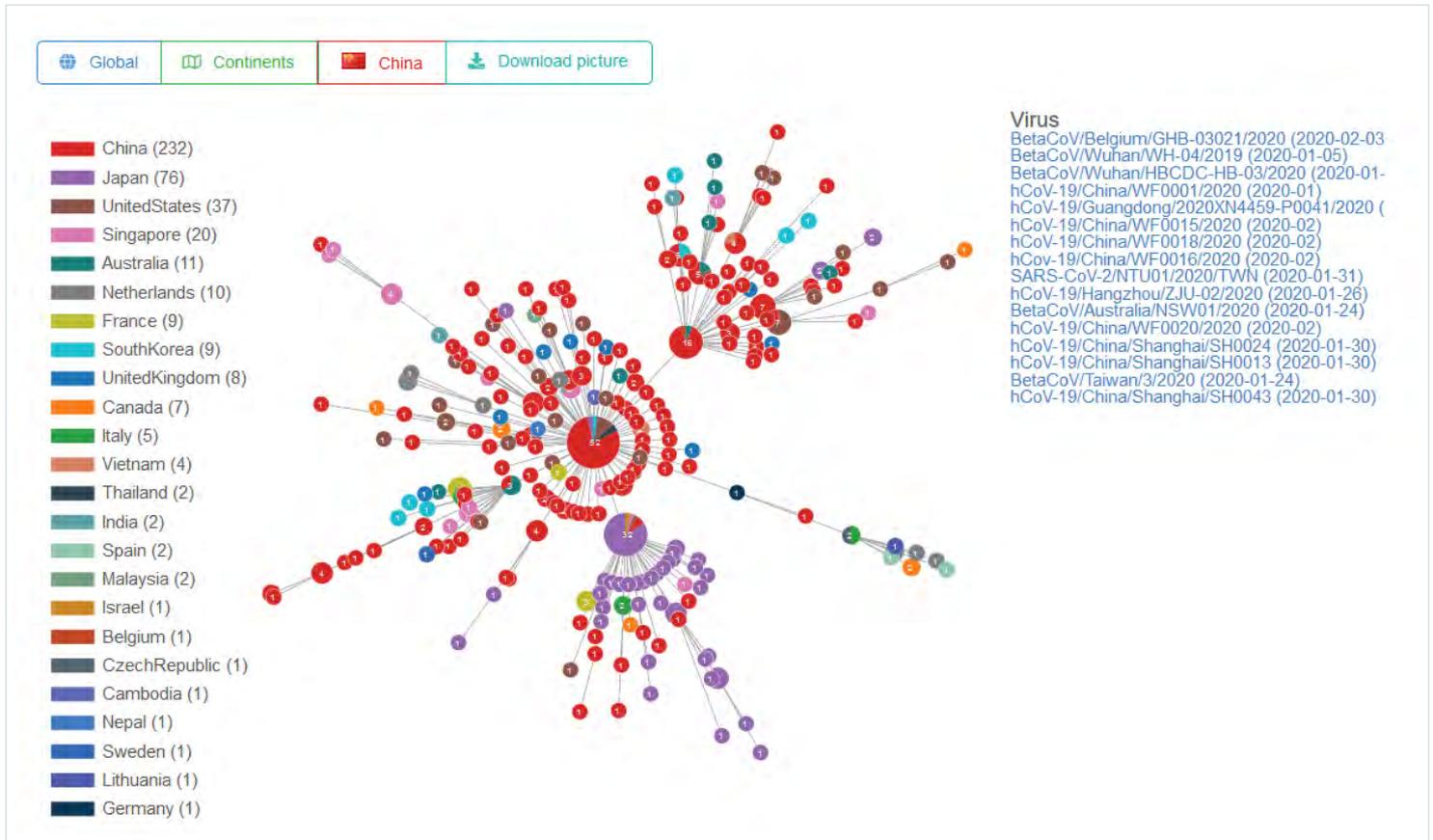
options have been tested in confirmed patients. However, up to now, there are still no specific antiviral drugs or vaccines against 2019-nCoV infection. Among multiple candidate drugs under screening, Remdesivir (RDV) is the most promising (Agostini et al., 2018; Sheahan et al., 2020). The successful use of RDV in the first case of COVID-19 in the United States posted the bright perspective (Wang et al., 2020). In vitro experiments indicate that RDV could inhibit 2019-nCoV (Holshue et al., 2020). A randomized, double-blind, parallel-controlled phase 3 clinical trial of safety and efficacy of RDV is ongoing.

2019-nCoV appears to spread fairly easily. To reduce the transmission of 2019-nCoV, intervention measures such as travel bans and quarantine should be adopted effectively. Due to the absence of effective treatments, the best way to deal with the epidemic is to cut off the sources of infection. For individuals, protective measures, such as personal hygiene, medical masks, adequate rest, and well-ventilated room, can effectively prevent 2019-nCoV infection (Sun et al., 2020).

2019 Novel Coronavirus Resource

To promote data sharing and make all relevant information of 2019-nCoV publicly available, the 2019 Novel Coronavirus Resource (2019nCoV, <https://bigd.big.ac.cn/ncov>) was created by China National Center for Bioinformatics (Zhao et al., 2020). It features comprehensive integration of genomic and proteomic sequences as well as their metadata

information from major databases hosting 2019-nCoV sequences. It also incorporates a wide range of relevant information including scientific literatures, news, and popular articles for science dissemination, and provides visualization functionalities for genome variation analysis results based on all collected data.



A haplotype network map of SARS-CoV-2 genomes created by 2019nCoV

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COVID-19

Basic Facts and Knowledge for Public Dissemination

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What Is a Coronavirus?

Coronaviruses are named for the crown-like protrusions on the virion surface, which give the appearance of a “crown”, or “corona”, as observed under the electron microscope. There are four main sub-groups of coronaviruses (alpha, beta, gamma and delta), in which some of the viruses are known to infect humans.

Common human coronaviruses known to infect humans include: 229E (alphacoronavirus), NL63 (alphacoronavirus), OC43 (beta coronavirus), HKU1 (betacoronavirus), which cause a mild, flu-like disease in humans. These four pathogens can be found worldwide. Other less common coronaviruses known to infect humans include Middle East Respiratory Syndrome coronavirus (MERS-CoV), which can cause severe respiratory disease in humans with renal failure and has a mortality rate of ~30%, Severe Acute Respiratory Syndrome coronavirus (SARS-CoV), which can cause severe respiratory disease in humans with a fatality rate of ~10%, and since December 2019, a novel coronavirus (2019-nCoV), which can cause severe respiratory disease in humans with a fatality rate of ~2-4%.

What Is the Difference Between 2019-nCoV and COVID-19?

2019-nCoV refers to the aetiologic agent (the causative virus). Coronavirus Disease 2019 (COVID-19) refers to the clinical disease observed in humans due to infection with 2019-nCoV (such as cough, difficulty breathing, pneumonia, etc.)

What Are the Routes of Transmission for This Virus?

The initial routes of transmission occurred from animal-to-human (the animal reservoir has not yet been identified). However, it should be noted that human-to-human transmission has been documented and this spread can happen on a continuum. Nosocomial spread and community spread of 2019-nCoV has been documented in areas now experiencing their own clusters of COVID-19 cases from an imported, infectious patient. So far, live virus can be detected in throat swabs, sputum, bronchoalveolar lavage fluid and feces samples from confirmed COVID-19 patients.



What Can We Do to Prevent 2019-nCoV Transmission, and Can Someone Who Has Recovered from COVID-19 Still Be Infectious?

2019-nCoV is spreading from person-to-person, and those acutely ill with COVID-19 can spread the illness to others. Currently, WHO guidelines recommend that actively sick patients should be isolated either in the hospital or at home (depending on how sick they are), until the patients have recovered and no longer pose a risk to infecting other people. Release from quarantine should be made on a case-by-case basis and patients should meet the following requirements: 1) free from fever without the use of fever-reducing medications; 2) no longer showing symptoms, including cough; 3) tested negative by an approved reverse

transcription polymerase chain reaction (RT-PCR) protocol on at least two consecutive respiratory specimens, collected at least 24 hours apart.

Who Is at Higher Risk of Severe Disease from COVID-19?

There are subpopulations that are at risk of developing severe disease after 2019-nCoV infection. These include: 1) older adults (over the age of 60); 2) people who have serious pre-existing, chronic medical conditions including but not limited to: a) heart disease, b) diabetes, and c) lung disease. Those at a higher risk for serious illness from COVID-19 should take actions to reduce the risk of being infected with 2019-nCoV.



Is It True That Children Are Not Affected by This Novel Coronavirus?

There are observations from several studies that young children and younger adults are less susceptible to 2019-nCoV infection and even if COVID-19 develops, the symptoms are not as severe. However, it is not currently known why this is the case, and regardless the proper precautions should still be adhered to during this pandemic.



What Precautions Should I Take?

It is essential to have good hygiene to prevent the spread of 2019-nCoV. Recommended precautions include: 1) Keeping at least 1-2 meters of space between yourself and others to limit close contact; 2) Wash hands often with soap or at least cleanse with antimicrobial agents; 3) Avoid crowds as much as possible, but if need to go out for necessities, wear an face mask approved for preventing virus spread and try to avoid areas with high densities of people; 4) Avoid travel on cruise ships (as outbreaks have been documented on several cruise ships already), and non-essential air travel; and 5) If there is a COVID-19 outbreak in the community, stay home as much as possible to reduce infection risk, also monitor yourself for possible symptoms (such as fever, cough, etc.). If there are any symptoms, seek medical help.

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