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COVID-19: Zoonotic aspects



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Dear Editor

Coronaviruses can cause severe diseases in humans and animals, as has been stated recently by Biscayart et al. [1]. China has experienced several viral outbreaks in the last three decades; avian influenza outbreak in 1997, severe acute respiratory syndrome (SARS) in 2003 [2], and severe fever with thrombocytopenia syndrome (SFTS) in 2010 [3]. In China, yet another pathogenic human coronavirus outbreak was reported in the city of Wuhan, Hubei province. Wuhan is an urban town located in the central part of China. It is one of the significant transportations and business hubs. In 2018, the city comprised of a population of approximately 11.9 million, and one of the seventh most populous Chinese city [1,4].

On December 12, 2019, the Wuhan Municipal Health Commission (WMHC) reported 27 individuals infected by a new coronavirus designated initially as 2019-novel coronavirus (2019-nCoV), and later as Coronavirus Disease 2019 (COVID-19) by the World Health Organization (WHO). Of the reported cases, seven were critically ill and had a history of exposure with the Seafood Wholesale Market.

An early study conducted in January 2020, among 41 patients (median age 49 years), positive for SARS-CoV-2 infection (the causative agent of COVID-19), found that half of them had underlying diseases, including diabetes 20%, cardiovascular disease 15%, and hypertension 15%. Their symptoms were mainly fever 98%, cough 76%, and fatigue 44%. The COVID-19 severe complications in such patients included respiratory distress syndrome 29%, RNAemia 15%, acute cardiac injury 12%, and other secondary infections. Of the total infected patients, 32% were admitted to an Intensive Care Unit (ICU). The death rate was 15% [5].

Emerging viruses that spread to humans from an animal host are proven to be some of the deadliest diseases known [2,3]. COVID-19 is thought to be transmitted from the animals, though it has not yet been clear exactly from which animal, however the animals have been the sources of transmission as described in Fig. 1. The recent finding shows that SARS-CoV-2 is 96% identical to a bat coronavirus [2]. We aimed to discuss the zoonotic transmission of SARS-CoV-2 to humans.

In the last few weeks, the number of cases has been increased and pose a threat to public health. The region Wuhan is the potential hot-spots of coronavirus infection in China. Daily, the number of cases has been significantly increased, and be tracked at [https://gisanddata.](https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6)

[maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6](https://gisanddata.maps.arcgis.com/apps/opsdashboard/index.html#/bda7594740fd40299423467b48e9ecf6). The overall case fatality rate has been stable for weeks less than 3%. However, an increased number of cases in China and outside posed an international emergency. Therefore, countries with limited resources prepared and strengthen the disease surveillance system to report and diagnose any case of COVID-19.

Coronaviruses were identified in the mid-1960s and known to infect humans and other animals, including birds and mammals. Epithelial cells in the respiratory and gastrointestinal tract are the primary target cells. Due to these characters, viral shedding occurs via these systems and transmission can occur through different routes, i.e., fomites, air-borne or fecal-oral. To date, seven coronaviruses have been shown to infect humans. Common human coronaviruses *Betacoronavirus* HCoV-OC43 and HCoV-HKU1, as well as *Alphacoronavirus* HCoV-229E, cause common colds and severe lower respiratory tract infections in infants and elderly, while *Alphacoronavirus* HCoV-NL63 is found to be a significant cause of (pseudo) croup and bronchiolitis in children [1].

New zoonotic coronaviruses have emerged and caused outbreaks in humans; SARS-CoV (2002, *Betacoronavirus*, subgenus *Sarbecovirus*), and MERS-CoV (2012, *Betacoronavirus*, subgenus *Merbecovirus*). In late 2019, a novel coronavirus related to a cluster of pneumonia cases in Wuhan, China (2019-nCoV), was identified. After that the disease designed as COVID-19. The SARS-CoV-2 is closely related to SARS-CoV and genetically clusters within *Betacoronavirus* subgenus *Sarbecovirus* [1].

An early study conducted by Li and colleagues reported that of the total 425 patients' (median age was 59 years) highest number of cases, 55% had a history of Seafood Wholesale Market. Besides, 56% of patients were male, and the mean incubation period was 5.2 days. The Seafood market located at Wuhan, where different types of wild (snakes and marmots) and domesticated (poultry and bats) animals were sold illegally. Thus, suggested the disease may be transmitted from animals to humans (Fig. 1). Till now, the specific source and reservoir of SARS-CoV-2 are not explicitly known yet.

During the COVID-19 outbreak, although earlier transmissions were from the animals after reporting four individuals from Seafood Wholesale Market, all other transmissions are believed to be from human to human (Fig. 1). This mode of transmission was so active that within a few days, it flew to other countries. A recent study identified

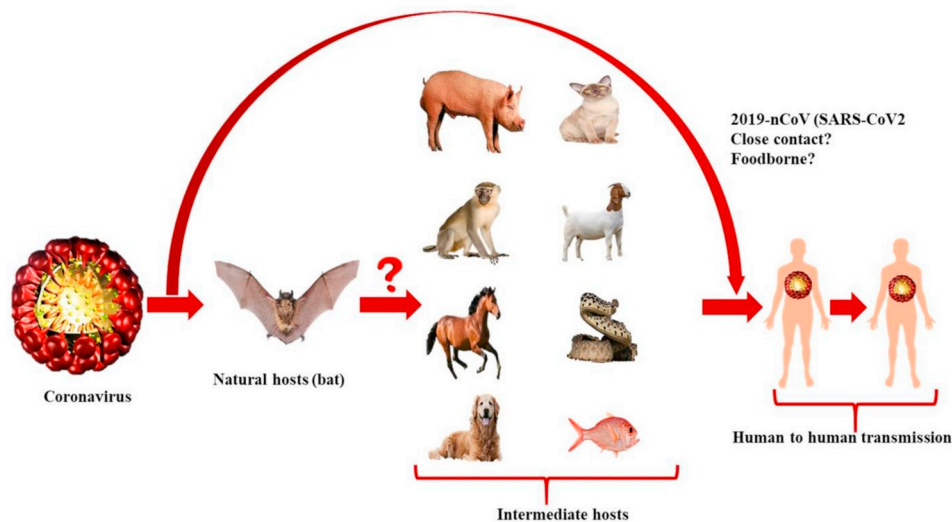


Fig. 1. Potential transmission cycles of SARS-CoV2 (formerly 2019nCoV).

human to human transmission of COVID-19. A Chinese (Shanghai resident) between January 19, 2020 and January 22, 2020 had visited Germany. During her stay in Germany, she developed no signs and symptoms of COVID-19, but she was tested positive after came back to China on January 26, 2020. On January 24, 2020, a 33 years old German businessman became ill had chills, sore throat, and myalgias. The patient history showed that he had a meeting with a Chinese business partner on 20 and January 21, 2020. Later, on January 28, 2020, another three employees at the company were found positive for COVID-19.

Animal to human transmission can be reduced more quickly as compared to humans [2]. In the recent outbreak, transmission from humans to humans increased many folds due to annual celebrations in China during which the movement of the masses increased allot. Human to human transmission can happen in several ways. It can be through the droplets from the cough or sneeze, surfaces of public transport, restaurants, and other public places (toilets, elevators, bus stops).

As have occurred in the past with other zoonotic conditions [2], the spillover of a new coronavirus, SARS-CoV-2, is now significant. Originating in bats, current and previous coronaviruses, such as SARS-CoV and MERS-CoV, are a matter of concern in the interaction between animals and humans, with the future concern of new epidemics in China and abroad.

Author contributions

Conceptualization: TA and MK. Data curation: TA. Writing—original draft preparation: TA. Writing—review, and editing: TA, MK, H, THM, SN, DKB-A, and AJR-M. Supervision and funding acquisition: JH.

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CRediT authorship contribution statement

Tauseef Ahmad: Writing - original draft. **Muhammad Khan:** Writing - review & editing, Writing - original draft. **Haroon:** Writing - review & editing. **Taha Hussein Musa:** Writing - review & editing. **Saima Nasir:** Writing - review & editing. **Jin Hui:** Writing - review & editing. **D.Katherine Bonilla-Aldana:** Writing - review & editing. **Alfonso J. Rodriguez-Morales:** Writing - review & editing, Writing - original draft.

Declaration of competing interest

All authors report no potential conflicts. All authors have submitted the Form for Disclosure of Potential.

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Tauseef Ahmad
Department of Epidemiology and Health Statistics, School of Public Health,
Southeast University, Nanjing, 210009, China
Key Laboratory of Environmental Medicine Engineering, Ministry of
Education, School of Public Health, Southeast University, Nanjing, China

Muhammad Khan
Department of Genetics, Centre for Human Genetics, Hazara University
Mansehra, Khyber Pakhtunkhwa, Islamic, Pakistan

Haroon
College of Life Science, Northwest University, Xian, China

Taha Hussein Musa
Department of Epidemiology and Health Statistics, School of Public Health,
Southeast University, Nanjing, 210009, China
Key Laboratory of Environmental Medicine Engineering, Ministry of
Education, School of Public Health, Southeast University, Nanjing, China

Saima Nasir
Allama Iqbal Open University, Islamabad, Islamic, Pakistan

Jin Hui
Department of Epidemiology and Health Statistics, School of Public Health,
Southeast University, Nanjing, 210009, China
Key Laboratory of Environmental Medicine Engineering, Ministry of

Education, School of Public Health, Southeast University, Nanjing, China

D.Katterine Bonilla-Aldana
Incubator in Zoonosis (SIZOO), Biodiversity and Ecosystem Conservation
Research Group (BIOECOS), Fundación Universitaria Autónoma de las
Américas, Sede Pereira, Pereira, Risaralda, Colombia
Public Health and Infection Research Group, Faculty of Health Sciences,
Universidad Tecnológica de Pereira, Pereira, Colombia

Alfonso J. Rodriguez-Morales*
Public Health and Infection Research Group, Faculty of Health Sciences,
Universidad Tecnológica de Pereira, Pereira, Colombia
Grupo de Investigación Biomedicina, Faculty of Medicine, Fundación
Universitaria Autónoma de las Américas, Pereira, Risaralda, Colombia
E-mail address: arodriguezm@utp.edu.co

* Corresponding author. Public Health and Infection Research Group, Faculty of Health Sciences, Universidad Tecnológica de Pereira, Pereira, Risaralda, Colombia.