



# An Overview and Update of COVID-19: Can SARS-Coronavirus-2 Infect Farm Animals?

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**Abstract** | Coronaviruses have been recognized as causing pathological conditions to humans and animals since the 1960s and 1970s. Coronaviruses discovered from avian species are classified to the Genera Gamma- and Delta Coronaviruses which include the highly contagious infectious bronchitis viruses in poultry. Currently, we are facing a new Coronavirus called Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) that causes Coronavirus disease 2019 (COVID-19). This new disease has rapidly converted from epidemic to pandemic according to the World Health Organization (WHO). Genetic analyses of public genome sequence data from SARS-Coronavirus-2 and related viruses found no evidence that this new virus was created or developed in a laboratory. Understanding the dynamics of this new virus, its mode of transmission, and how to avoid it, has become nowadays necessary. The main purposes of this review are to summarize recent discoveries related to this virus and to understand how to protect ourselves and our animals (pets, livestock) from it. The virus spreads mainly from humans to humans or from animals to humans through the air and by touching contaminated materials and it remains for several hours on surfaces and objects. Up till now, there is no enough evidence of any transmission of this virus from humans to animals (including birds) or from animals to animals. Furthermore, there is no confirmed vaccine against the new Coronavirus disease 2019 for humans or animals. Therefore, the best way to prevent yourself and your animals is by following the WHO standard recommendations, hygiene practices, and avoid contact with wild animals.

**Keywords** | Animal, Dissemination, Prevention, SARS-Coronavirus-2, Vaccine

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## INTRODUCTION

Among the most common viruses infecting a wide variety of animals (including birds) and humans are representatives of the large Coronaviridae family with the largest single-stranded positive sense RNA genome which continuously circulates in the host and poses a threat not only to animals but also to humans (Gorbalenya et al., 2006). Recently, it was detected a new developed Coronavirus named SARS-Coronavirus-2 (SARS-CoV-2) that causes Coronavirus disease 2019 (COVID-19) (Lai et al., 2020). SARS-Coronavirus-2 is an enveloped virus with a single-strand RNA genome of zoonotic origin, which

continuously circulates in hosts and poses a threat not only to animals but also to humans. The new disease caused by this virus (COVID-19) has rapidly moved from outbreak, epidemic to pandemic according to the WHO. Genetic analyses of public genome sequence data from SARS-CoV-2 and related viruses found no evidence that this new virus was created or developed in a laboratory, and the most probable origin for this new virus is the natural selection (natural development) in an animal host that could be the bat and then it transmitted to humans by unhealthy habits (Scripps Research Institute, 2020; Andersen et al., 2020). Li et al. (2020) indicated that the animal can serve as a key intermediate host for the recombination and evolution

of SARS-CoV-2. Coronaviruses are characterized as like other RNA viruses by high mutation and recombination (Milek and Blicharz-Domańska, 2018), which may contribute to the creation of new viruses such as SARS-CoV (2002), MERS-CoV (2012), and SARS-CoV-2 (2019). However, understanding the structure of this new virus, mode of transmission, and how to avoid it, have become nowadays necessary. Therefore, the main purposes of this review are to summarize recent discoveries related with this virus, discuss whether SARS-Coronavirus-2 can infect farm animals, and how to protect ourselves and our animals against it.

### WHAT IS COVID-19?

It is a new disease caused by a novel virus named SARS-CoV-2, and this virus belongs to Coronaviruses family (Li et al., 2020). Coronaviruses are a large group of viruses; the seven Coronaviruses affecting humans can cause a range of symptoms, including a fever, headache, runny nose, cough, and sore throat (Li et al., 2020). Some are mild, but others tend to cause pneumonia. These kinds of viruses are usually spread and transmitted through direct contact with an infected host (Chen, 2020). Coronaviruses also cause a range of diseases in farm animals and domesticated pets, some of which can be dangerous and pose a threat to the farming industry (Milek and Blicharz-Domańska, 2018). They have been identified in numerous mammalian and avian hosts. Most widely studied and of common occurrence are Coronaviruses reported in rabbits (rabbit Coronavirus), cattle (bovine enteric and respiratory Coronaviruses), swine (porcine hemagglutinating encephalomyelitis virus, porcine transmissible gastroenteritis virus, and porcine respiratory Coronavirus), cats (feline infectious peritonitis virus and feline enteric Coronavirus), dogs (canine enteric Coronaviruses), as well as in chickens (infectious bronchitis virus (IBV)), and turkeys (turkey enteric Coronaviruses) (Holmes, 1999). Coronaviruses, in general, cause a variety of diseases in mammals and birds ranging from enteritis in cows and pigs to upper respiratory disease in chickens (Fehr and Perlman, 2015). Bovine CoV, and chicken IBV cause mild to severe respiratory tract infections in cattle, and chickens, respectively. IBV significantly reduces egg production and egg weight in laying flock farms (Perlman and Netland, 2009). However, most animals carry a range of pathogens (bacteria and viruses) that can cause diseases; and humans have always caught these diseases from animals, particularly from wild animals. Recent research has reported that SARS-CoV-2 is likely to originate in bats (Zhou et al., 2020), and transmitted to humans, and is then easily transferred from humans to others worldwide. Thus, COVID-19 is a highly transmittable and pathogenic viral infection which emerged in Wuhan, China and spread around the world. The recent researches (Zhou et al., 2020; Li et al., 2020; Chen, 2020) have indicated that this virus

is a natural product of evolution, and can infect people of any age; particularly elderly or individuals with preexisting health conditions such as diabetics and asthmatics are more likely to be susceptible to this disease. Until now, this virus has infected over 4 million persons, and caused death for over 290 thousand persons from over 215 countries/areas according to latest update of WHO (14 May, 2020). Therefore, COVID-19 has rapidly moved from outbreak, epidemic to pandemic according to the WHO. At present, France has reported the seventh-highest number of COVID-19 infections worldwide, according to the data obtained by Johns Hopkins University (14 May, 2020), behind United States, Russia, United Kingdom, Spain, Italy and Brazil respectively. The new virus has challenged many countries' public health and economic infrastructure (Singhal, 2020).

### DID SARS-CoV-2 SPREAD FROM ANIMALS TO HUMANS AND CONTRARIWISE?

SARS-CoV-2 is a new member in Coronaviruses family, that are common in several species of domestic and wild animals, including livestock such as cows, horses, camels, chickens, and also pets such as dogs, cats, as well as bats. Thus, it has common characteristics with them, particularly with the last two major Coronavirus: SARS-CoV (2002) and MERS-CoV (2012) that were transmitted to humans through intermediate hosts: the masked palm civet (civet cats) and dromedary camels, respectively (Chen, 2020). Recent investigations (Li et al., 2020; Chen, 2020) suggest that SARS-CoV-2 (2019) emerged also from an animal source, but in this case, SARS-Coronavirus-2 is transmitted through bats that can be a natural reservoir host for several viruses which can cross species barriers (Wang et al., 2006; Banerjee et al., 2019). Genetic sequence data reveals that the SARS-Coronavirus-2 is a close relative of other CoV found circulating in *Rhinolophus* bat populations (Zhou et al., 2020). It means that SARS-Coronavirus-2 can transmit from animals to humans. Moreover, human-to-human spread has been confirmed and caused outbreaks in several countries. To date, there are not enough scientific evidences that SARS-Coronavirus-2 can transmit from infected humans to animals or from animals to animals. The scientific team at Harbin Veterinary Research Institute concluded that some animal species such as cats, and may be dogs, can be infected by this virus, but chickens, ducks, and pigs are not likely to catch it (Mallapaty, 2020). Moreover, Shi et al. (2020) found that SARS-CoV-2 replicates weakly in avian such as chicken, but ferrets, and cats are permissive to infection. These findings are in agreement with Perlman and Netland (2009) that reported that chickens were unlikely to have been infected by SARS-CoV. However, further investigations will be needed to confirm these findings.

### HOW IS THIS VIRUS SPREAD?

According to the Centers for Disease Control and Prevention (CDC) and World Health Organization (WHO) reports, this virus spreads mainly from person-to-person by the following ways.

1. Direct/close contact (within about 5-7 feet) with infected person:
  - Via respiratory droplets produced from him.
  - Via coughs or sneezes.
2. Touching a surface or object that has the virus on it and then touching your nose, mouth, and eyes (this virus can live on surfaces up to 3 days under certain conditions).

Moreover, this virus can spread from animals-to-humans by the same previous ways.

### WHAT ARE THE SYMPTOMS?

According to the CDC and WHO reports, symptoms are ranged from mild to severe and sometimes caused death; and the time from exposure to onset of symptoms is ranged from 2-14 days (incubation period). The COVID-19 has flu-like symptoms (common symptoms) such as cough, fever, and fatigue. In addition, there are specific symptoms related with COVID-19 such as sore throat, throat dryness, and breathlessness (difficult to take a deep breath). On the other hand, there are no confirmed symptoms have been detected on infected animals until now.

### HOW TO PREVENT AND PROTECT YOURSELF AND YOUR ANIMALS FROM THIS DISEASE?

Currently, there are no confirmed COVID-19 vaccines available for humans or animals. There are several clinical trials in many countries to determine the safest and most effective vaccine. From a couple of days, Sinovac Biotech Company (an experienced vaccine-maker, China) has created a new COVID-19 vaccine by growing the novel Coronavirus in the VERO monkey cell line and inactivating it with chemicals (<https://www.sciencemag.org/news/2020/04/covid-19-vaccine>). It is one of the many COVID-19 vaccines in development has protected an animal, rhesus macaques, from infection by SARS-Coronavirus-2 with no obvious side effects on the monkeys. However, the only way to prevent/protect yourself and your animals now from the infection is by following the standard practice recommendations:

- The isolation of infected cases.
- Trying to stay at home whether you are safe or sick.
- Washing hands often with soap and water for at least 20 seconds.
- Using an alcohol-based hand sanitizer with not less than 70% alcohol.
- Avoid touching your nose, mouth, and eyes frequently.
- Avoid handshake or kissing each other.
- Cover your mouth and nose with a tissue when

coughing or sneezing.

- Consider wearing a properly fitting mask to help prevent the virus from spreading and limit contacts with other people in public areas.
- Gargle the mouth and throat using a diluted solution of vinegar (acetic acid) and salt (sodium chloride) to avoid the infection has not been confirmed.
- Try to use 0.1% sodium hypochlorite or 65-70% ethanol for surfaces/objects disinfection (Kampf et al., 2020).
- Try to enhance your immunity by eating healthy food, exercise, and avoid depression or nervousness.
- Try to check and examine your pets and farm animals frequently, and provide them a good veterinary care.
- Try to keep your animals save from other wild animals to avoid the transmission of this virus.

Milek and Blicharz-Domańska (2018) reported that wild animal species serve as a natural reservoir for several emerging zoonotic pathogens and thus have important public health impacts. Therefore, the WHO recommends infection control interventions to reduce the general risk of transmission of acute respiratory infections, including avoiding unprotected contact with wild animals. However, we do not rule out to detect other novel Coronaviruses emerge in the future, maybe after less than 10 years this time; so, we need to be ready from now because it is really a high-risk threat to human and animal life with several features including health, production, and economy. Therefore, public health authorities should continue to monitor the current situation and find out more about this novel virus.

### CONCLUSION

Until now, there is no enough evidence of any transmission of this virus from humans to animals (including birds) or from animals to animals, but it could be possible. Additionally, there is no confirmed/available vaccine against the new Coronavirus disease 2019 for humans or farm animals. Therefore, the best way to prevent yourself and your animals is to follow the WHO standard recommendations, and avoid contact with wild animals.

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KE-S collected the data and wrote the article. FS, SA and NM revised it.

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## ANIMAL WELFARE STATEMENT

The authors confirm that the ethical policies of the journal, as noted on the journal's author guidelines page, have been adhered to "No ethical approval was required as this is a review article with no original research data".

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