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# Transmission of SARS-CoV-2 between humans and company animals

## Transmissão do SARS-CoV-2 entre humanos e animais de companhia

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**Abstract**
Faced with the current pandemic of the new coronavirus (COVID-19), many doubts have arisen in society and fake news has been disseminated on social media about the transmission of SARS-CoV-2 between animals and humans, thus increasing the number of animals abandoned by tutors after the beginning of the pandemic. This review brings information from studies carried out on COVID-19 and pets. A bibliographic review of scientific publications was carried out: periodicals, magazines, books and articles on the subject. With the results, it was observed that although dogs and cats are affected by the new coronavirus, their transmission to humans has not been confirmed, however, there are suspected cases that humans can transmit the virus to animals and that probably, only the cats can transmit the virus interspecies.
**Keywords:** Cats; Covid-19; Dogs; Pets.

**Resumo**
Diante da atual pandemia do novo coronavírus (COVID-19) muitas dúvidas surgiram na sociedade e *fake news* foram divulgadas nas redes sociais sobre a transmissão do SARS-CoV-2 entre animais e humanos aumentando assim quantidade de animais abandonados pelos tutores após o início da pandemia. Esta revisão traz informações de estudos realizados sobre o COVID-19 e os animais de estimação. Realizou-se uma revisão bibliográfica de publicações científicas: periódicos, revistas, livros e artigos a respeito do tema. Com os resultados observou-se que apesar dos cães e gatos serem acometidos pelo novo coronavírus, não foi confirmado a transmissão destes para os humanos, no entanto, existem casos suspeitos que os humanos possam transmitir o vírus para os animais e que provavelmente, apenas os gatos possam transmitir o vírus interespécie.
**Palavras-chave:** Gatos; Covid-19; Cães; Animais de Estimação.

**Resumen**
Ante la actual pandemia del nuevo coronavirus (COVID-19), muchas dudas han surgido en la sociedad y se han difundido fake news en las redes sociales sobre la transmisión del SARS-CoV-2 entre animales y humanos, aumentando así el número de animales abandonados por los tutores tras el inicio de la pandemia. Esta revisión trae información de estudios realizados sobre COVID-19 y mascotas. Se realizó una revisión bibliográfica de publicaciones científicas: periódicos, revistas, libros y artículos sobre el tema. Con los resultados se observó que si bien los perros y gatos se ven afectados por el nuevo coronavirus, no se ha confirmado su transmisión a humanos, sin embargo, existen casos sospechosos de que los humanos pueden transmitir el virus a los animales y que probablemente, solo los gatos pueden transmitir. eso. el virus entre especies.
**Palabras clave:** Gatos; Covid-19; Perros; Mascotas.

## 1. Introduction

The new coronavirus, also known as COVID-19, is a highly contagious infectious disease caused by SARS-CoV-2 (Brito, 2020), an RNA enveloped virus, unsegmented and single-tape (Fung; Liu, 2019), which belongs to the genus Betacoronavirus and integrates the subgenus Sarbecovirus (Khalil, 2020). COVID-19 disease appeared in 2019 in Wuhan, China, and soon became a pandemic. It is currently responsible for more than 612,000 deaths in Brazil and is disseminated in more than 100 countries worldwide, mainly affecting the health of the population and the world economy (Who, 2020). Researchers suspect that COVID-19 disease would be a zoonosis, since probably the first cases arose, through the ingestion of a bat soup, which was sold in a seafood market, where wild animal sales occurred illegally in the Wuhan region of China (Wu, et al., 2020).

Wu et al. (2020) observed through studies the similarity of 89.1% of nucleotides with coronavirus due to bats in China, defining this as the main suspect of original host of SARS-CoV-2. Besides, Lam. (2020) and Wong. (2020) proved similarity in the coronavirus genome present in Malaysian pangolins (*Manis javanica*) with the new coronavirus, which is probably the intermediate host. It is important to note that even before the COVID-19 pandemic, dogs and cats were already affected by other virus species of the coronaviridae family. In dogs, canine enteric coronavirus (CCoV), for which there is already vaccination, and canine respiratory coronavirus (CRCoV) stands out. Cats have a history of feline coronavirus (FCoV) infection, which also has a vaccine protocol available (Jericho, 2015).

Thus, due to the already reported existence of coronavirus in companion animals, there was a concern by the part of tutors and health professionals that these animals could be related to the COVID-19 transmission cycle in humans. Even though humans are the most affected by the new coronavirus, several other animals may end up infected through infected humans, such as: domestic animals and wild animals that are in zoos (Segalés et al., 2020; Andrade et al., 2021. Hence, Shen et al. (2020) indicates that diagnostic tests may be carried out in animals which their tutors tested positive for COVID-19.

However, this fact generated a great controversy among veterinarians, since the sale of tests for COVID-19 and masks for pets began to be propagate in an attempt to prevent the transmission of COVID-19, even when domestic animals did not present a history or confirmation of transmission to humans. Due to the dissemination of the information in journalistic media, the Federal Council of Veterinary Medicine (CFMV) released a statement confirming that dogs and cats are not transmitters of COVID-19 and the use of tests and masks on pets would not be indicated by the World Organization for Animal Health (OIE).

In several countries, cases of dogs and cats reagent for the new coronavirus has been confirmed, and cases from Brazil, Spain and Belgium has been confirmed after tutors tested positive for COVID-19. Dogs and cats have become members of families, with greater contact with humans, hence there is a greater concern about the transmission of diseases, currently, due to the pandemic, and there is a great concern with the transmission of SARS-CoV-2 by these animals (Jardim, 2020).

Thus, the objective of this literature review is to bring information about the transmission of COVID-19 between domestic animals and humans.

## 2. Methodology

A search using ScienceDirect, Web of Science, PubMed, Google Scholar, Sciel, Scopus databases and magazines and books was performed to identify all relevant publications regarding the transmission of COVID-19 between domestic animals and humans up to January 2021. Descriptors such as COVID-19 and domestic animals, transmission of COVID-19 between animals and humans and impact of the pandemic on pets were used.

## 3. Results and Discussion

Several cases of dogs and cats that tested positive for the virus emerged after the COVID-19 pandemic. In Brazil, Spain and Belgium, cases of animals with COVID-19 were confirmed after contacting infected humans.

Given the approximation between animals and humans and doubts about the possible transmission of Sars Cov-2 between them, the World Small Animal Veterinary Association - WSAVA (2020) recommended that tutors diagnosed positive for COVID-19, should maintain the distance with their pets due to the great chance of the virus undergoing mutations and, therefore, affecting several species, since some pets (dogs and cats) in the United Kingdom were diagnosed with B.1.1.7 infection, which the researchers denominated a variant of concern.

According to Ferasin. (2021) one dog and two cats were reagentby the polymerase chain reaction (PCR) test. In addition, others obtained the presence of antibodies against the virus and developed myocarditis. Still in this study, nothing was proven to suggest animal-to-animal or animal-human transmission through the variant of the new coronavirus, however, the presence of δ69-70 gene variant B.1.1.7 could be a characteristic that would make this virus more likely to be infectious for dogs and cats.

In Brazil, the confirmation of human-to-animal transmission was made through clinical research conducted with animals in which their tutors had tested positive for COVID-19 (Andrade, 2021). Two dogs living in Curitiba were confirmed positive, and was reported that they slept in their guardians' bed. The first presented mild nasal secretion, but the next day after the first test, presented a negative result and the second tested positive for COVID-19 at the same time that the tutors were sick (Miranda, 2020).

A study conducted in partnership with Fiocruz, the National Institute of Infectious Diseases Evandro Chagas (INI) and the Oswaldo Cruz Institute (IOC) investigated 39 pets (29 dogs and 10 cats) of tutors with COVID -19. After serological testing of these animals, it was confirmed that 9 dogs and 4 cats were seropositive for SARS-CoV-2. They shared the bed with the tutors and 6 of these animals had mild clinical signs with reversible condition (Calvet et al., 2021). A research conducted by Shi et al. (2020) proved that some animals, such as ferrets and cats, are infected when exposed to a high load of SARS-Cov-2 were. The ferrets presents some clinical alterations in the upper respiratory tract and in cats there was replication of the virus in the nasal region and larynx, causing inflammation in the respiratory tract. In cat necropsy, it was possible to see the presence of massive lesions in the mucosal epithelium region, in areas of the trachea, lungs and narines, in addition, by placing infected cats together with healthy ones it was noticed that the virus can be transmitted between cats through the airway. The study also reports that there is no transmission between dogs and proved low susceptibility of these animals to be infected by the virus.

The susceptibility of domestic cats to acquire the infection is associated with the similarity of the cell receptor ACE2 - Angiotensin-Converter Enzyme 2, an enzyme capable of facilitating the entry of the virus into the cell with humans. As described by Stout et al. (2020), this similarity is 85.2%, behind only the primates *Pan Troglodytes*, which has 99% and *Macaca mulatta*, with 94.9%. This enzyme is important because it is able to facilitate the entry of the virus into the cell through interaction with the Spike protein present in SARS-Cov-2 (Nishioka, 2020).

In 2020 a cat was referred to a veterinary hospital in Spain after showing clinical signs of dyspnea, shortly after contacting his tutor and other family members who tested positive for COVID-19. The animal worsened the next day and died being referred for necropsy, which concluded that the animal developed secondary thromboembolism, in addition to cardiorespiratory insufficiency due to hypertrophic cardiomyopathy. Tests were performed to verify whether the lesions were caused by the SARS-CoV-2 virus and by detecting RNA SARS-CoV-2 and the presence of antibodies it was proven that the animal had a productive COVID-19 viral infection and was caused precisely by contact with the tutors who tested positive for the virus (Segalés, 2020). In Belgium, it was also confirmed the case of a cat with COVID-19 after contact with her guardian

who had the disease. The cat showed clinical signs such as lethargy, prostration, anorexia and diarrhea, in addition to the presence of cough and dyspnea. After treatment, she recovered from the disease (Garigliany et al., 2020).

In 2020 researchers analyzed serological samples from 102 cats in Wuhan to assess whether they had antibodies to SARS-CoV-2. From this sample, 15 cats (14.7%) had positive serology in enzyme immunoabsorption assay (ELISA) and 11 (10.8%), positive with the presence of neutralizing antibodies through the viral neutralization test (VNT) (Zhang et al., 2020).

In the same year, a study conducted in France analyzed whole blood samples from dogs and cats through Microsphere Immunoassay (MIA) tests and seroneutralization assay. The tutors of these animals were divided into two groups: those who received a positive diagnosis for COVID-19 and those with an unknown profile. From the first group, samples were collected from 13 dogs and 34 cats 2 to 3 months after their guardians were diagnosed with the disease. As for the second group, samples of 22 dogs and 16 cats were collected. During the collections, all animals underwent clinical examination and none showed clinical signs indicating physiological alterations.

Of the 47 animals whose guardians were previously diagnosed with COVID-19, 10 (21.3%) tested positive. Of these, 8 (23.5%) cats and 2 (15.4%) dogs. Of the 38 animals that lived in homes where their guardians had an unknown profile for the disease, only 1 animal (cat) was reagent for the virus (Fritz, 2020).

In Hong Kong 2021, a 17-year-old, Pomeranian male dog tested low positive for SARS-CoV-2. The diagnosis was made through the Real-Time Polymerase Chain Reaction (RT-PCR) test, in which samples of oral, nasal and oral contents were collected for the test). The animal's guardian had contracted the infection previously, which could suggest human-animal transmission. It is noteworthy that the dog did not present the clinical symptomatology frequently associated with the disease.

Also in Hong Kong, two male dogs whose tutor had been infected by COVID-19 performed the RT-PCR test for the said disease: one of them, a German shepherd, two years old, tested positive and the other, No Defined Breed, tested negative. Neither of them present any characteristic symptoms (Lopes, 2020).

## 4. Conclusion

It is noticed that the transmission of COVID-19 from humans to domestic animals is probable, however, there are still no confirmed cases of transmission of SARS-Cov-2 from these animals to humans.

The recommendation of health agencies is that guardians, when infected by the new coronavirus, avoid maintaining direct contact with their pet animals, so that they prevent dogs and cats from becoming infected.

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