



The role of pets in SARS-CoV-2 transmission: an exploratory analysis

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Abstract

Purpose There is evidence that humans can transmit SARS-CoV-2 to cats and dogs. However, there is no evidence that they can transmit it back to humans or play any role in SARS-CoV-2 transmission. Here, we present an exploratory analysis on that matter.

Methods We conducted a case–control study with participants with flu-like symptoms seeking care at a primary healthcare unit to be tested for COVID-19. They were asked if they owned pet cats and/or dogs in their residences, and this variable was evaluated as exposure.

Results The odds ratio of “having dogs and/or cats in the residence” was 1.29 (95% CI 1.08–1.54) of “having only dogs and no cats” was 1.26 (1.05–1.52), and “no dogs and only cats” was 1.29 (0.95–1.75).

Conclusion Having a cat/dog in the house can affect the risk of infection by SARS-CoV-2.

Keywords Pet · Dog · Cat · SARS-CoV-2 · COVID-19

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Introduction

The role of cats and dogs in the transmission and epidemiology of coronavirus disease 2019 (COVID-19) has been previously discussed [1–10]. Here, we present new data and further discuss that role.

Cats and dogs can be infected with severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) [3–7]. They may also develop COVID-19 with similar disease course and manifestation to humans, including respiratory symptoms and worse disease outcomes when comorbidities are present. Likewise, dogs may develop symptoms in the upper respiratory tract [5–7].

There are data strongly suggesting that humans can transmit SARS-CoV-2 to their cats and dogs [5–8], as well as evidence that experimentally infected cats can transmit the virus to non-infected ones [4, 8]. Nevertheless, there is no evidence supporting the hypothesis that cats and dogs could transmit the virus back to humans [8–10].

Some studies point out that cats may have a limited role in the COVID-19 epidemiology [8, 9]. Considering that cats and dogs can be infected with SARS-CoV-2 and that both may develop symptoms in a similar way that humans do [3–6], it would be reasonable to think about the possibility

of these domestic animals transmitting the virus back to humans—and hence, being a risk factor for human infection. To help fill this knowledge gap, we evaluated whether cats and/or dogs living with humans may be a risk factor for SARS-CoV-2 infection in humans.

Methods

We conducted a case–control study to assess if the exposure of “having a pet [dog(s)/cat(s)] is associated with having COVID-19. Our sample comprised patients that sought medical care with flu-like symptoms. They were asked whether they owned pet cats and/or dogs to evaluate the exposure to pets as an associated risk of having SARS-CoV-2 infection. The context in which interviews were conducted, limited primary data were collected, as it was not possible to conduct long interviews.

From 8 March to 31 November 2021, patients with flu-like/respiratory syndrome symptoms seeking medical care at a primary healthcare center in Cidade Estrutural (city nearby Brasília, Distrito Federal, Brazil) were invited to participate in our study about COVID-19 incidence. Cidade Estrutural is home to a vulnerable population with a low per capita income (R\$ 573.3, equivalent to USD\$ 115.0 on May 18, 2022), low education level (6% are illiterate, and only 3.5% graduated college) and poor urban and sanitary infrastructure (23.9% of houses have improvised or no sanitary infrastructure at all) [11]. Houses are built very close to each other—in many cases without a clear division of the limits of each residence.

All patients agreeing to participate signed consent instruments, were interviewed, and had nasopharyngeal samples collected using a swab for SARS-CoV-2 detection by RT-qPCR. The survey included questions about socio-demographic descriptors and the presence of pets in their residences.

The inclusion criteria were: (1) answering whether there were any pets in their residences, and if they did, specifying which kind, and (2) having a valid result (positive or negative) in the SARS-CoV-2 detection test. Those who did not meet these criteria were excluded. The exposures evaluated were: having dogs and/or cats in the residence; having dogs and no cats in the residence; having cats and no dogs in the residence. *Cases* were defined as patients with flu-like symptoms with SARS-CoV-2 detected by RT-qPCR and *controls* were patients with flu-symptoms with negative RT-qPCR for SARS-CoV-2.

RT-qPCR assays were performed with SARS-CoV-2 RNA isolated from nasopharyngeal swab samples. Nucleic acid extraction was conducted with the EXTRACTA 32 kit (MVXA-P016 FAST) in a Loccus automated extractor following manufacturer’s instructions. SARS-CoV-2 was

detected by the RT-qPCR Allplex™ 2019-nCoV Assay (Seegene Inc.) for the amplification of genes *E*, *RdRP* and *N*, as well as an internal control gene, according to the manufacturer’s protocol. RT-qPCR results were considered positive (SARS-CoV-2 RNA detected) when the internal control and at least two genes were amplified, negative (SARS-CoV-2 RNA not detected) when the internal control and none or only one gene was amplified, and inconclusive when the internal control did not amplify. Inconclusive results were repeated one time.

Sample characteristics were described with descriptive statistics. *Odds ratio* (and its respective 95% confidence interval) of having a pet dog/cat in relation to being SARS-CoV-2-positive in RT-qPCR was then calculated.

All procedures were conducted in accordance with the ethical standards for research with human participants following the recommendations of the institutional and national research committees and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. The study was approved by the Research Ethics Committee of the Faculty of Medicine at University of Brasília (CEP-FM/UnB, CAAE 39892420.7.1001.5558; CAAE 40557020.6.3001.5553) and Fundação de Ensino e Pesquisa em Ciências da Saúde (FEPECS/SES/DF, CAAE 40557020.6.3001.5553).

Results

A total of 2397 participants answered YES or NO to whether there were any pets in their residences. Our 2397 participants comprised 62.5% (1497) female, 37.4% (897) male and 0.1% (3) did not answer this question; 2.5% (61) have no formal education, 29.3% (702) have completed elementary school, 50.8% (1217) have high school education, 16.4% (392) have a college degree, and 1% (25) did not answer this question. Regarding race, 78.8% (1888) self-declared as mixed-race or black; 14.8% (356) white; 3.1% (74) Asian; 1.4% (34) Indigenous, and 1.9% (45) declared another race or did not answer the question. The mean age was 33.4 years old (median 31, Q1–Q3 23–42).

Out of those 2397 patients, 2322 (96.9%) had valid positive or negative results for SARS-CoV-2 detection by RT-qPCR, and 75 (3.1%) had inconclusive results and were therefore excluded from our analysis. Out of the remaining 2322 respondents, 739 (31.8%; 95% confidence interval [95% CI] 29.9–33.7) had positive RT-qPCR results.

Among those 2322 participants, 53.2% (1236) had a pet in their residence. Out of those, 61.3% (757/1236) had at least one dog and no cats in their residence; 16% (197/1236) had at least one cat and no dogs; 18% (223/1236) had cats and dogs in their residence; 2.4% (30/1236) had birds. A total of 2.3% (29/1236) did not specify which kind of pet they

Table 1 Number of participants with positive/negative test results for detection of SARS-CoV-2 and the *odds ratio* values for human exposure to dog(s) and/or cat(s)

| Exposures | Outcomes | | Total | <i>Odds ratio</i> (95% CI) |
|--|------------------|------------------|-------|----------------------------|
| | RT-qPCR positive | RT-qPCR negative | | |
| Having dogs and/or cats in the residence | | | | |
| Yes | 406 | 771 | 1177 | 1.29 (1.08–1.54) |
| No | 323 | 793 | 1116 | |
| Having dogs and no cats in the residence | | | | |
| Yes | 267 | 490 | 757 | 1.26 (1.05–1.52) |
| No | 462 | 1074 | 1536 | |
| Having cats and no dogs in the residence | | | | |
| Yes | 73 | 124 | 197 | 1.29 (0.95–1.75) |
| No | 656 | 1440 | 2096 | |

owned and were excluded from our study. Our final sample comprises 2293 participants who (1) answered whether they owned a pet; (2) specified the kind of pet they owned, and (3) received a valid positive or negative RT-qPCR result for SARS-CoV-2 infection.

We found that among the 2293 participants, 729 (31.8%; 95% CI 29.9–33.7) tested positive for SARS-CoV-2, and 1177 (51.3%) were exposed to the presence of dogs and/or cats in their residence.

The *odds ratio* (OR) for the presence of cats and/or dogs in human dwellings is shown in Table 1.

Discussion

The presented OR values (see Table 1) should be taken with some precaution. First, because previous reports indicate that pets are susceptible to transmission of SARS-CoV-2 from their owners [4–10], second, there is no scientific evidence to support that pets can transmit SARS-CoV-2 to humans [1–10]. However, our results could indicate that pets can contribute, somehow, to the SARS-CoV-2 transmission. It is noteworthy that distance and limits between houses in our study population very likely impact the interaction between humans and animals—pets or otherwise, but we could not assess such information.

Therefore, there is a need for more research to understand SARS-CoV-2 epidemiology among humans and pet animals. A better understanding of the specific role of pets in the current COVID-19 epidemiology, using a One Health approach, might contribute to minimizing undefendable abandonment based on fear of transmission of SARS-CoV-2 [8–10]. Finally, the magnitude of the association between the presence of pets and the risk of humans having SARS-CoV-2 infection is small. Therefore, any intervention in

this direction would have, if any, a very small impact on transmission. Summing it all up, pet owners with COVID-19 should not interact with their dogs or cats during the disease course to avoid transmitting the virus to their pets.

Author contributions AIPT, RNB, CCG conceptualized and designed the study, analyzed all data, and drafted the initial manuscript. GASR, WMR, WNA, RH, and EFN performed critical revision of the manuscript. All authors read and approved the final manuscript.

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Availability of data and materials Data are available upon request from the corresponding author.

Code availability Not applicable.

Declarations

Conflict of interest The authors declare no relevant financial or non-financial interests to disclose.

Ethics approval The study was approved by the Research Ethics Committee of the Faculty of Medicine at University of Brasília (CEP-FM/UnB, CAAE 39892420.7.1001.5558; CAAE 40557020.6.3001.5553) and Fundação de Ensino e Pesquisa em Ciências da Saúde (FEPECS/SES/DF, CAAE 40557020.6.3001.5553).

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