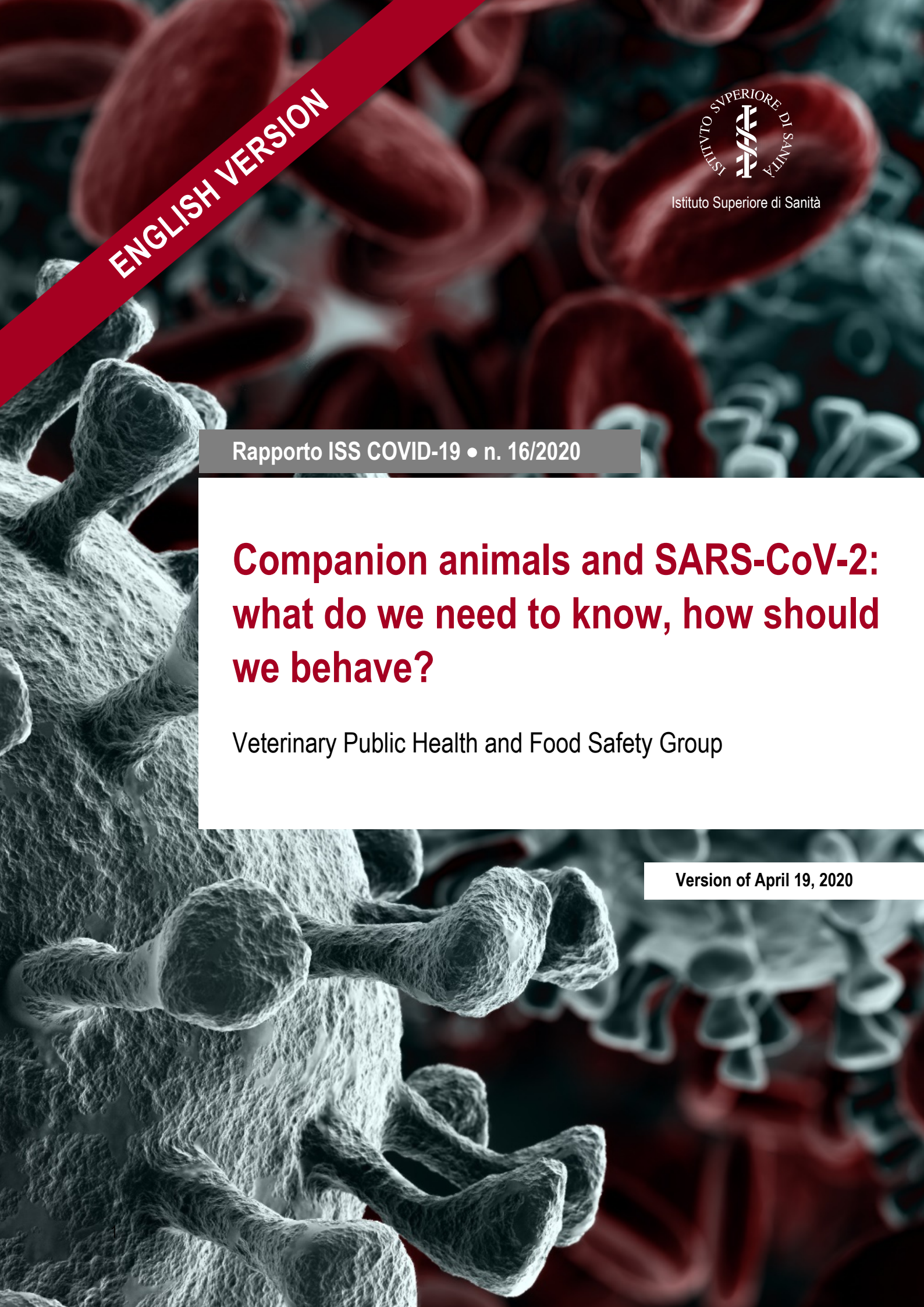

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Companion animals and SARS-CoV-2: what do we need to know, how should we behave?

Veterinary Public Health and Food Safety Group

Version of April 19, 2020

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ISS COVID-19 Veterinary Public Health and Food Safety Working Group

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Although COVID-19 is spread by human-to-human transmission, reports of cases in which infected owners have transmitted the virus to their animals, together with evidence from experimental infection studies, have recently raised the issue of SARS-CoV-2 susceptibility of pet animals. Although it is considered a rare occurrence, the possibility that animals could acquire the infection calls for the adoption of precautionary measures aimed at minimising this risk, in order to protect both companion animals and their carers. For the purpose of preparedness and prevention, this report aims to provide information and interim One-Health guidance, for medical and veterinary professionals and all those involved in the management of pet health during the current COVID-19 epidemic.

The original Italian version of ISS COVID-19 Reports are available at: **https://www.iss.it/rapporti-covid-19**

The reports translated in English are available from: **https://www.iss.it/rapporti-iss-covid-19-in-english**

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Target of the report

This report is intended for professionals working for the Italian National Health Service (medical doctors, veterinary professionals, biologists, health workers) and veterinarians who, with various roles and responsibilities, are involved in caring for the health of companion animals and in veterinary public health work. The report also provides information and guidance for all those who care for companion animals.

Acronyms

COVID-19	Coronavirus Disease 2019
FAO	Food and Agriculture Organization of the United Nations
MERS	Middle East Respiratory Syndrome
OIE	World Organization for Animal Health (formerly known as Office International des Epizooties)
PFU	Plaque Forming Unit
PPE	Personal Protective Equipment
PRC	People's Republic of China
SARS	Severe Acute Respiratory Syndrome
SARS-CoV-2	Severe Acute Respiratory Syndrome Coronavirus 2 the coronavirus that causes COVID-19
TCID	Tissue Culture Infectious Dose
WHO	World Health Organization

Introduction

The novel human coronavirus *S*evere Acute Respiratory Syndrome Coronavirus type 2 (SARS-CoV-2), which causes Coronavirus Disease 2019 (COVID-19), having left its alleged wild animal reservoir (1), spread rapidly throughout the province of Hubei (People's Republic of China) and to all continents of the world, having found in humans a receptive population capable of efficient intraspecies transmission. From the time the first cases were reported in December 2019, the epidemic spread rapidly, culminating in the declaration of pandemic status by the WHO (March 11, 2020). Italy declared a state of emergency on January 31, 2020 and was hit by the epidemic wave in late February (2).

Recently, some observational and experimental evidence has drawn the attention of the scientific community and health authorities to the issue of the susceptibility of companion animals to SARS-CoV-2. Indeed, it has been observed that the virus can occasionally be transmitted from humans to animals. What is known as the "cross-species transmission" is a process that characterises the natural evolutional potential of viruses. Cross-species transmission involving humans or those animal species with the most direct contact with them gives rise to unpredictable epidemiological scenarios for public health. In these cases, measures and practices that minimise the risk of infection must be adopted, for the purposes of prevention. This report deals with the topic on the basis of the currently available information. The aim is to provide public veterinary services, as well as veterinary professionals, pet-owners and the general population, with basic guidance for the management of companion animals during the pandemic, in the interests of animal welfare and health and in order to guarantee public health.

Although the *Rapporti ISS COVID-19* (ISS COVID-19 Reports) are intended primarily for use by healthcare professionals, as they are available online, they are also consulted by much of the general public. More than half of all Italian families own at least one pet and consequently issues regarding animal welfare are of great interest to public opinion. This report is an opportunity to share information and analyses in a widespread and transparent manner, in our interest and that of our four-legged companions, and it includes an annex containing an infographic for communication purposes.

Coronaviruses and their relevance for veterinary public health

General information

Coronaviruses are a diverse group of viruses that affect a number of animal species and humans (3). The name 'coronavirus' is inspired by the appearance of these viruses when viewed using an electron microscope, in that they are characterised by the presence of an outer envelope with glycoprotein spikes that give the virus its characteristic crown-like form (120-160 nm in diameter). They are positive-sense single-stranded RNA viruses of the family *Coronaviridae*, subfamily *Orthocoronavirinae;* the latter being further broken down into four genera: *Alpha-* (Alfa-CoV), *Beta-* (Beta-CoV), *Gamma-* (Gamma-CoV) and *Deltacoronavirus* (Delta-CoV). The Alfa-CoV and Beta-CoV infect mammals, whereas the Gamma-CoV and Delta-CoV primarily infect birds. Exceptions are the cetacean Gamma-CoV and the porcine Delta-CoV (3-4).

Coronaviruses have always represented a significant animal health concern, as they are responsible for a large number of diseases of veterinary interest with a high economic impact (5). These viruses present marked tropism for the epithelium of the respiratory and digestive tracts and therefore result in clinical conditions that are usually associated with respiratory and gastrointestinal syndromes. There are, nevertheless, a number of significant exceptions, associated with multiorgan diseases such as feline infectious peritonitis (FIP), which show that coronaviruses are able to adapt well also to different cell and tissue types. The coronaviruses present evident host specificities. However, their ability to mutate and recombine make them particularly prone to changes in their pathogenic potential and host spectrum, by performing what is known as "cross species transmission" or spillover (6).

Zoonotic potential of coronaviruses

The low-pathogenic human coronaviruses (HCoV) 229E and OC43, which were isolated in the 1960s, and the more recently discovered HCoV NL-63 and HKU1, are major causes of common colds and only rarely result in lower respiratory tract infections with bronchitis and pneumonia. Epidemiological studies conducted in the 2000s showed that 15-30% of human respiratory infections are caused by coronaviruses (4).

Comparative evolutionary studies on animal and human coronaviruses have suggested that all the coronaviruses that are endemic in humans originated from animal reservoirs, such as bats (HCoV-229E and HCoV-NL63) and rodents (HCoV-OC43 and HCoV-HKU1), before infecting humans either directly or following adaptation in another mammalian species (alpaca for HCoV-229E, cattle for HCoV-OC43) (3-7). These studies confirmed the coronaviruses' propensity to cross the barriers between species and cause new diseases.

The appearance of Severe Acute Respiratory Syndrome (SARS) in 2003 and Middle-East Respiratory Syndrome (MERS) in 2012, caused by SARS-CoV and MERS-CoV, respectively, testified to the zoonotic potential of coronaviruses. Indeed, comparative genomic studies have identified certain species of chiropters (the mammalian order to which bats belong) as the reservoirs from which the viruses responsible for SARS and MERS originated, with the aid of intermediate animal hosts, more specifically, wild carnivores and dromedaries, respectively (8-9).

The likelihood of a virus infecting a given species is associated with its ability to recognise, adhere to and penetrate the cells of that species. The affinity between the spike protein's binding site and the receptor on the host cell is a crucial factor for defining the susceptibility of a given species to that virus, its host range and its transmission capacity. The structure of the spike protein contains the virus' Receptor-Binding Domain (RBD) with which it binds to the host cell receptor. The characteristics of this domain, which vary between the different coronaviruses, help to confer host specificity. In the case of SARS-CoV and SARS-CoV-2, the domain binds with the angiotensin-converting enzyme 2 (ACE2) receptor, whereas for MERS-CoV it binds with another protein known as Dipeptidyl Peptidase-4 (DPP4) (10).

Recent evidence of SARS-CoV-2 transmission to companion animals

The susceptibility of companion animals to human coronaviruses is a matter of scientific and health interest. In 2003, during the SARS epidemic, which was caused by SARS-CoV, a virus very similar to SARS-CoV-2, a study published by a group of Dutch researchers showed that cats and ferrets were susceptible to the human virus, using experimental infection models based on intratracheal inoculation (11). The animals acquired the infection but, whereas ferrets developed symptoms (lethargy and conjunctivitis), the cats did not present any clinical signs of illness. Both species, however, were able to transmit the infection to other healthy animals that came into contact with the infected animals.

In 2003, in a cluster of SARS that occurred in the Amoy Gardens condominium in Hong Kong, where 329 residents contracted the disease, domestic cats were also tested and were found to have been infected by SARS-CoV (12, 13).

For SARS-CoV-2, natural cases of infection in animals were recently reported, and the first data from studies using experimental infection models have been published.

Observational evidence

On February 26, 2020, a 17-year-old Pomeranian dog owned by a COVID-19 patient living in Hong Kong gave a weak positive result for SARS-CoV-2 on nasal and pharyngeal swabs. The dog did not present any symptoms of disease. After the dog had been quarantined, weak positive results were obtained for a further five molecular tests performed on swabs collected over a 12-day period. Once the dog's swab tests had become negative, the animal was returned to its owner. Two days later, the dog died for reasons that, according to the Hong Kong authorities, did not appear to be related to coronavirus, but to pre-existing kidney and heart problems. The owner did not consent to an autopsy to establish the cause of death. To date, attempts to isolate the virus have been unsuccessful. Serological tests, however, have detected the presence of specific antibodies, thus confirming the infection (14).

On March 18, 2020, a second dog (a German shepherd) in Hong Kong, owned by a patient with COVID-19, tested positive for SARS-CoV-2 in molecular tests performed on nasal, oral and rectal swabs. The animal lived with another dog, which tested negative for the virus. Neither animal showed significant clinical symptoms. The molecular tests (viral RNA) performed on the positive dog confirmed the same result for the 3 following days, after which the results became negative. The serological tests, on the other hand, revealed the presence of specific antibodies. It was possible to isolate SARS-CoV-2 from the samples collected (15).

Again in Hong Kong, in addition to the two dogs described above, a cat (belonging to a COVID-19 patient) was also reported to have tested positive for SARS-CoV-2. The animal, which did not show any signs of illness, tested positive on the nasal, pharyngeal and rectal swab tests (16).

Overall, as at 31 March 2020, 27 dogs and 15 cats have been tested for SARS-CoV-2, in Hong Kong.

On March 27, 2020, at Liege University in Belgium, SARS-CoV-2 RNA was detected in the faeces and vomit of a cat presenting respiratory and gastrointestinal symptoms. The animal had developed the symptoms a week after its owners had returned from Italy and tested positive for COVID-19. The animal presented obvious clinical symptoms, characterised by loss of appetite, vomiting, diarrhoea, breathing difficulties and cough, which improved spontaneously, starting from the ninth day after the onset of the disease. The report conducted by the Scientific Committee established by the Belgian Federal Food Safety Authority reported that a high quantity of viral genetic material was found in the vomit and, to a lesser degree, in the stools of the animal. This finding, together with the clinical symptoms, suggests that, after being exposed to infection by its owners, the animal experienced productive viral infection, i.e. infection associated with active replication of the virus (17).

On April 6, 2020, the US media reported that a 4-year-old Malaysian tiger at New York's Bronx Zoo had tested positive for SARS-CoV-2. The tiger presented with a dry cough and loss of appetite and the positive results were confirmed by the veterinary laboratories of the United States Department of Agriculture (USDA). In addition to that tiger, clinical symptoms were also observed in her sister, two Amur tigers and three African lions. The USDA concluded that the animals had been infected by a carer with asymptomatic infection (18).

Experimental studies

In addition to observations of natural cases of infection, the results of studies on the experimental transmission of SARS-CoV-2 to the animals are progressively being published.

Cats

A recent experimental study reported the first results on the susceptibility of certain animal species to SARS-CoV-2 (19). In cats, intranasal inoculation with human SARS-CoV-2 resulted in findings of viral RNA, in some cases with high burdens, in the pharynx (soft palate, tonsils) and upper airways (nasal cavity and passages, turbinates, trachea) and in the intestine. Viral RNA was also detected in one of three uninoculated cats housed in cages adjacent to those of the infected animals. The cats developed antibodies against SARS-CoV-2, which were detected by ELISA and neutralisation tests. The same experimental approach, used in younger cats (70-100 days-old), showed the appearance of more severe signs of disease (19). In general, the infection persisted for longer and some of the animals died. The older cats were able to overcome the infection more quickly and did not present severe clinical signs. Overall, these results show that SARS-CoV-2 can replicate effectively in cats, with younger cats proving more susceptible and that the virus can be passed on from an infected animal to a healthy one.

Another study found specific antibodies against SARS-CoV-2 in the serum of cats in the Hubei area (PRC). Out of 102 cat serum samples collected from asymptomatic subjects during the epidemic, 15 samples (14.7%) contained specific antibodies against SARS-CoV-2 (ELISA method), whereas all the cat serum samples collected before the start of the epidemic (n=39), were negative. Of the positive samples, 11 had SARS-CoV-2-neutralising antibodies, with titres between 1/20 and 1/1080. The animals with the highest antibody titre (1/1080) lived in close contact with subjects positive for COVID-19. These data show that Wuhan's cat population was exposed to SARS-CoV-2 during the epidemic (20) and a significant portion acquired the infection.

Ferrets

The first experimental study on the susceptibility of ferrets to SARS-CoV-2 showed that animals infected by intranasal inoculation presented high temperature and viral replication. The virus was found in nasal lavages, saliva, urine and faeces for up to 8 days after infection. Viral antigens were detected in the nasal turbinates, trachea, lungs (where an acute bronchiolitis was observed), kidneys and intestine. Moreover, the presence of viral RNA was detected in a number of non-infected ferrets housed in cages that did not permit

direct contact with the infected animals, an indication of the inhalatory transmission of the infection. The Authors concluded that infection in ferrets is, in many ways, similar to the disease in humans (21)

Similar results regarding ferret susceptibility were reported in a second study conducted by intranasal inoculation with SARS-CoV-2. Again, the animals presented a high temperature and loss of appetite. Viral genome (RNA) was present in the nasal lavages and rectal swabs for up to 8 days after infection. The presence of the virus was only observed in the upper airways, although lungs were affected by severe inflammatory lesions (perivasculitis and lymphoplasmacytic vasculitis, increase in the number of type II pneumocytes, macrophages and neutrophils in the alveolar septa and alveolar lumen). Antibodies against SARS-CoV-2 were detected in all the ferrets (19).

Dogs

The previously-cited study (19) also analysed the susceptibility of dogs to SARS-CoV-2. The results demonstrated that this species is less susceptible than cats. Just one out of the four dogs experimentally infected with the same doses of the virus as used for cats and ferrets (10^5 PFU/mL) tested positive. Furthermore, viral genome was only detected on the rectal swab test, whereas the respiratory tract tissues tested negative. SARA-Cov-2 antibodies were detected (ELISA method) in two out four animals experimentally infected with SARS-CoV-2, 14 days after infection. All the experimental animals were asymptomatic. Lastly, it was observed that the infected dogs were not able to pass the infection other healthy dogs (n=2) brought into contact with the experimentally infected group.

Other species

Other experimental infection studies were conducted in Germany at the *Friedrich Loeffler Institute* by administering SARS-CoV-2 via the intranasal route (10^5 TCID50) to pigs, chickens, fruit bats (*Rousettus aegyptiacus*) and ferrets. Ferrets and bats were seen to be susceptible to the infection, unlike pigs and chickens. The most efficient viral replication, with the highest viral burdens, was observed in ferrets. Three non-experimentally-infected ferrets housed in cages close to the infected animals, also tested positive. Although, as claimed by the Authors, the study is still on-going, the preliminary results confirm the data obtained in similar studies conducted in the PRC (22).

Two very recent studies analysed the susceptibility of hamsters (*Mesocricetus auratus*) to intranasal infection with SARS-CoV-2. Both studies reported that hamsters have significant susceptibility to the virus. The animals developed mild symptoms characterised by lethargy, ruffled coat, moderate weight loss and increased respiratory rate. Viral replication in the respiratory and intestinal tract is accompanied by histological findings of exudative alveolar damage in the lungs, followed by the appearance of areas of consolidation. The clinical and pathological status undergoes a progressive, complete remission within approximately 2 weeks, when the appearance of neutralising antibodies is observed. Healthy hamsters housed in the same cages as the experimentally-infected animals also contract the infection, a sign of the potential for intraspecies transmission of the virus (23, 24).

The study cited previously for cats, ferrets and dogs also tested livestock species, such as pigs, ducks and chickens and excluded, in the experimental conditions adopted, their susceptibility to SARS-CoV-2 (19). These are, however, preliminary data that require further experimental confirmation, also in view of the fact that SARS-CoV, which is closely genetically and biologically related to SARS-CoV-2, was naturally able to infect pigs (25-26).

How to use and improve our knowledge regarding SARS-CoV-2 for the management of companion animals in the current epidemic setting

The rapid evolution of scientific production regarding COVID-19 in all the countries affected by the pandemic will make it possible to reduce the uncertainty associated with the knowledge gap concerning the epidemiological aspects of SARS-CoV-2. The World Organization for Animal Health (OIE) also affirms that containment measures can only be adapted to veterinary issues following a thorough risk analysis.

The current Italian epidemiological setting allows us to acquire observational data in order to further improve the characterisation of risk in companion animals. The assessment of the SARS-CoV-2 risk could be based on the results of monitoring, epidemiological studies in animal populations and *ad hoc* research activities. This would be an important legacy that would make it possible to improve the risk management measures and make them increasingly suitable and appropriate.

What we know

- The evidence described in the previous chapter on the susceptibility of companion animals to SARS-CoV-2 suggests that cats, ferrets and, to a lesser extent, dogs can acquire the infection. In the very few cases of natural infection that have been officially reported to date, it is considered that the animals contracted the infection from humans.
- In some cases, the infection would appear to have resulted in illness and it is reasonable to assume that the infected animals may have eliminated live virus in secretions and excretions, as occurs in humans, and in line with the results obtained from studies based on experimental infection. Nevertheless, at the current time, there is no evidence to suggest that companion animals play an epidemiological role in the spread of SARS-CoV-2 to humans. The epidemic spread of the virus occurs by human-to-human contact.
- To date there have been no reports of cases of SARS-CoV-2 in birds and the studies described previously suggest that avian species are not susceptible to the virus. Reptiles, amphibians and fish are not coronavirus hosts.
- In 2019, there were 32 million companion animals in Italy (1 every 53.1 inhabitants, the second highest pet ownership rate in the European Union) with 12.9 million birds, 7.5 million cats, 7 million dogs, 1.8 million small mammals (hamsters, rabbits, ferrets, etc.), 1.6 million fish and 1.3 million reptiles (27). According to the CENSIS [Social Investments Study Centre], pets were present in 52% of households, especially in those of separated and divorced (68%) and single individuals (54%).
- In the current Italian COVID-19 scenario (2), companion animals can potentially be exposed to SARS-CoV-2 virus at home and contract the infection through contact with infected individuals, as occurs for humans who live together. The actual risk of exposure for animals depends on a number of factors such as proximity, the duration and frequency of contacts between the animals and infected humans, the adoption of measures and practices to reduce these contacts and the use of pet hygiene and protection practices.

Conclusion

SARS-CoV-2 virus is spread through human-to-human contact. However, cats, ferrets and, to a lesser degree, dogs are also susceptible to SARS-CoV-2 infection. Although there is no evidence that pets play an epidemiological role in the spread of the virus in humans, it is possible that pets may contract the infection through contact with humans infected by SARS-CoV-2 and occasionally develop illness.

What we do not know

- As SARS-CoV-2 is a novel virus, there is a great deal of uncertainty regarding the virus in both humans and animals.
- The host range of SARS-CoV-2 is still unclear. Evidences available at the current time from observational and experimental studies, only concerns cats, ferrets, dogs and hamsters.
- The routes of infection in natural conditions, the infective dose and the potential for intraspecies infection in animals are not known.
- The reports of cases of natural infection in companion animals are the result of occasional observations. As there is no active monitoring programme, it is impossible to know the extent of the SARS-CoV-2 phenomenon in animals. This represents an element of uncertainty that can only be reduced through the organisation of *ad hoc* studies and systematic data acquisition in epidemic settings, including that of Italy.

Conclusion

Although there have been over 2.3 million confirmed cases of COVID-19 in humans worldwide, just four animals (two dogs and two cats) have been reported with a diagnosis of SARS-CoV-2 in natural conditions. Nevertheless, we must adopt a precautionary approach and prevent situations in which animals may contract the infection and eliminate the virus, as suggested by experimental infections.

What we could know with the aid of veterinary epidemiological monitoring

The OIE promote the acquisition and analysis of clinical and diagnostic information regarding suspected or confirmed cases of SARS-CoV-2 in companion animals, in order to make it possible to perform a risk analysis and adopt suitable containment measures for animals. The OIE considers SARS-CoV-2 in animals as an emerging disease (28).

Initiatives to analyse the risk of SARS-CoV-2 in pets could be based on clinical monitoring, seroprevalence studies and other epidemiological and experimental research activities.

Veterinary epidemiological monitoring should be structured to allow the acquisition of clinical observations and diagnostic information on SARS-CoV-2, in companion animals considered to be potentially at risk of infection. From an epidemiological standpoint, this would help to acquire the information needed to characterise the risk for pets and to record the clinical symptoms in the species affected.

- SARS-CoV-2 monitoring amongst pets calls for a close interaction between the various subjects responsible for their day-to-day care, treatment and healthcare: pet owners and voluntary associations, veterinary professionals, public veterinary services and other professionals working at the Prevention Departments of Local Health Authorities, the diagnostic laboratories of *Istituti Zooprofilattici Sperimentali* (Institutes for Research and control of Animal Disease) and University Departments of Veterinary Medicine. This interaction must be actively advocated and promoted, in order to further data acquisition, analysis and dissemination.
- It is important to acquire information not only on the results of SARS-CoV-2 testing, but also on the risk factors that may have facilitated animals' exposure.
- Data acquisition must be prompt and representative of the whole of the country, in order to avoid fragmentary and partial analyses. The monitoring data regarding SARS-CoV-2 in companion animals must be published as rapidly as possible and periodic epidemiological assessments should be issued.
- Animal monitoring data should be analysed within a context of cooperation and integration between the medical and veterinary sector that allows a comparative analysis with the human epidemiological trends. It is important to stress that the information collected must not, therefore, be restricted to "positive" findings (cases of SARS-CoV-2 infection), but should also include the negative results, in order to facilitate quantitative risk assessments.

Conclusion

Reducing the uncertainty regarding the risk of SARS-CoV-2 in companion animals will make it possible to formulate more effective guidelines and to adapt the measures for COVID-19 risk management with a One-Health approach. Following a risk-based approach, veterinary epidemiological monitoring should focus on animals exposed to humans with COVID-19, with special emphasis to animals that develop clinical illness and deceased animals. This kind of monitoring requires close and active cooperation between all subjects involved in the animals' day-to-day care, treatment and healthcare.

SARS-CoV-2 and companion animals: advice and operational guidelines

The purpose of this section of the report is to facilitate the management of the risk of SARS-CoV-2 infection in pets living in the home, a particular setting in which humans and animals share the same living spaces. The intention is to provide advice on how to analyse and interpret the available evidence, by applying it to the possible epidemiological scenarios associated with the epidemic spread of SARS-CoV-2 in humans.

In Italy, the spread of the vast outbreak of COVID-19 during 2020 led to an increasing need to define the current and future management of the SARS-CoV-2 risk in pets based on the evidence available and to coherently guide the measures and practices adopted by all those involved in day-to-day care and the management of animal health.

Companion animals bring happiness and improve our general wellbeing, especially at times of stress. If an individual does not have symptoms compatible with COVID-19 and is not self-isolating, walking a dog, providing it is in compliance with the regulatory provisions set forth in the "*Io resto a casa*" [I stay home] Decree (29) and subsequent national and regional regulations, and spending time with a pet, helps to maintain the health of both animal and owner. It is important to remember the high social/affective value of pets and the important role that animals play in the family and for the psychological and physical wellbeing of their carers. This is even more important in the current epidemic situation, especially for individuals who live alone, the elderly and children, who have the greatest difficulties coping with the social effects of the COVID-19 containment measures. At the same time, it is also necessary to stress the animals' rights for their health and welfare to be guaranteed.

It is undeniable that the restrictions imposed across Italy have generated challenging situations due also to the close and continuous cohabitation between man and animal. Difficulties regarding day-to-day care deserve special attention, due to their potential negative implications for the wellbeing of both humans and animals. It is also necessary to safeguard pets with important social functions, such as guide dogs and rescue dogs, many of which live in households.

Our knowledge of SAR-CoV-2, its evolution, host spectrum and epidemiological and transmission cycles continues to evolve rapidly. It is therefore fundamental to bear in mind that the guidelines for the management of SARS-CoV-2 risk in companion animals could undergo significant changes over time, in order to be fully in compliance with the evidence.

General principles for the management of companion animals during the COVID-19 epidemic

The aim of the containment measures imposed by the "*Io resto a casa*" Decree is to limit infection through social distancing, the adoption of appropriate practices and personal protective measures. These measures have restricted the free circulation of the population. From the start of the epidemic, the needs associated with the health and welfare of companion animals have been taken into serious consideration through temporary exemptions to the ban on people's movements outside of their homes, precisely to guarantee the animals' day-to-day care.

The aim of the containment measures is to reduce the individual risk of exposure to the SARS-CoV-2 virus. Considering the evidence available regarding the susceptibility of cats, ferrets and, to a lesser degree,

dogs, it is important to reduce this risk also for companion animals, by adopting in the home practices that make it possible to preserve the integrity, welfare and health of animals.

It is therefore important to focus on the following principles, which provide useful guidance for the management of pets in all those households that include dogs, cats and other mammals.

- **Animal welfare and health**. Even during epidemic events such as the current COVID-19 emergency it is important to continue to guarantee the welfare and health of pets and to guarantee them - compatibly with the current containment measures - the full expression of the attitudes, behaviour and characteristics that are typical of their species and breed. This also applies to households including humans with a suspected or confirmed diagnosis of COVID-19. In these cases, we must be prepared to manage potentially critical situations dictated by the cohabitation between humans and animals, in order to avoid the negative consequences for the animals and society as a whole (e.g. the abandonment of pets).
- **Risk of exposure to SARS-CoV-2 in the home.** In households where there are suspected or confirmed cases of COVID-19, the theoretical risk of exposure to SARS-CoV-2 for cohabiting companion animals is considered to be similar to that to which other humans living in the same household are exposed. It is therefore necessary to define and adopt measures to reduce the risk of exposure to SARS-CoV-2 in the home also for animals, through general hygiene rules for humans, animals and living spaces and, above all, through the adoption of appropriate practices by pet carers and other cohabiting individuals. These measures should be proportionate to the actual risk of COVID-19 in the household (e.g. the number of suspected or confirmed cases amongst the cohabiting individuals), the structure of the home and the possibility of physically separating the animals from the people who live with them, when necessary.
- **Animals in contact with individuals with suspected or confirmed COVID-19.** Cats, dogs, ferrets and other small mammals that live in the homes of persons with suspected or confirmed COVID-19 should be managed as potentially infectious "contacts". They should therefore be handled with a greater level of caution by those who attend to their day-to-day care and health. This principle is also enshrined in the "Guidelines for the management of pets suspected of SARS-CoV-2 infection" that were recently issued by the Ministry of Health. In the event of a suspected or confirmed case of COVID-19 amongst the members of a household, when the presence of pets has been confirmed, it must be reported to the Local Health Authority's veterinary services. When the initial swab test is performed on a member of the household, the epidemiological record will also include a survey of any pets and during the remote interviews over the following few days, the health of these subjects will also be monitored (30). The public and veterinary health services should cooperate using a One-Health approach to share information and analyses (28).

Conclusion

Even during the COVID-19 epidemic it is necessary to continue guaranteeing animal welfare and health. The risk of exposure to SARS-CoV-2 for companion animals is considered to be similar to that to which other humans living in the same household are exposed. In households where suspected or confirmed cases of COVID-19 are present, it is necessary to adopt measures to reduce the risk of exposure also for the animals.

Day-to-day care of companion animals

The animals' day-to-day care must always be provided safely by the caregiver, using personal protective equipment (PPE) suited to the specific setting (see dedicated section) in order to protect both the animal and the carer.

Owners

Owners must always guarantee basic pet care (feeding, hygiene, exercise, veterinary care), even during the COVID-19 epidemic. In the current scenario, day-to-day care may be more demanding than usual, due to both the logistical difficulties associated with the lockdown and because it may be necessary to implement supplementary measures in order to safeguard animal welfare and health. It is therefore necessary not to be caught unawares, to gather information and to responsibly evaluate one's actual ability to attend to the animals' day-to-day care. When necessary, owners should make timely provisions for external help, by getting their pets used to contact with relatives or neighbours who can attend to their pets if the owner is unable to do so.

Family/household members

If the owner or the person who usually looks after the animals is unable to for whatever reason, or if he/she is a suspected or confirmed COVID-19 case, it is essential that other family or household members attend to the animals' needs. External help should only be deployed when this is not possible.

External help

If the owner or other members of the household are unable to fully guarantee care for the animals, they should nevertheless remain in the owner's home. External help may be deployed for their day-to-day care needs. Help from external subjects (friends, relatives, dogsitters, volunteers) should be kept to a bare minimum and regard the satisfaction of the animal's physiological and feeding needs, and veterinary consultations or care.

Any external help should be guided by a precautionary approach when caring for animals and using PPE suited to the specific setting. If the animals to be cared for belong to a household in which there are individuals with suspected or confirmed COVID-19, any helpers must be informed in advance by the person seeking help.

Any subject who is foreign to the household and helps provide day-to-day care for the animals should approach the home and take charge of the animal without entering, in order to minimise human-to-human contact. The animal must be handed over by the owner or other member of the household to the external helper while observing social distancing practices and adopting measures such as to prevent the animal from escaping. For these operations, it may be useful to use animal containment equipment (leash, carriers). Animal care outside of the home must be provided so that animals are handled one at a time, unless they come from the same home, are kept on a leash, and are never left unattended.

Day-to-day care by individuals with suspected or confirmed COVID-19

Individuals with suspected or confirmed COVID-19 should not attend to the care of or have contact with the animals, and should delegate other members of the household or external helpers to attend to them. If it is not possible to make alternative arrangements for their animals' care, owners should attend to their pets without coming into direct contact with them and should wear PPE at all times. When the structure of the home permits, animals should be prevented access to those areas most at risk (e.g. kitchen, bathrooms) and contact with potentially contaminated materials (e.g. tableware used by the patient or leftover food) should be avoided.

Care by external helpers for animals left behind by persons who are hospitalised for or have passed away due to suspected or confirmed COVID-19

Animals may be left alone in the home, in the absence of their owner or other members of the household, provided safe conditions can be guaranteed for anyone entering the household. In the case of people who are hospitalised for or die of suspected or confirmed COVID-19, it is the responsibility of the owner (or family members or acquaintances, if the owner is unable) of the animals that are left alone, to inform the Veterinary Services or external carers of the fact that they were living with individuals who have been hospitalised for or died from suspected or confirmed COVID-19. The animals must be considered potentially infectious "contacts" and managed using PPE and procedures that are suited to the circumstances. The environment should be sanitised before any external helpers enter it. For further information on the sanitisation of environments, see ISS COVID-19 report no. 5-2020 "Interim guidelines for the prevention and management of indoor environments regarding the transmission of SARS-CoV-2 virus infection".

Conclusion

Individuals with a suspected or confirmed diagnosis of COVID-19 should avoid contact with animals present in their homes and whenever possible they should not attend to their day-to-day care. Pets should preferably be cared for by another member of the family or household and, when necessary, by an external helper. External helpers should adopt personal protective measures and procedures that minimise the risk of direct exposure (contact with other members of the household) or indirect exposure (contact with the domestic environment). External helpers should be informed in advance if the animal they are looking after belongs to a household in which individuals with a suspected or confirmed diagnosis of COVID-19 live or have lived.

Veterinary care

Veterinary care during the COVID-19 emergency

Although it is essential to continue safeguarding the pets' health, during the COVID-19 epidemic, all non-essential or deferrable movements must be avoided, including travel for veterinary consultations or house calls.

Remote veterinary care

In order to safeguard animal health, pets should continue to be cared for by their regular veterinary professional, who is familiar with the animal's medical and clinical history, by using, whenever possible, telemedicine or teleconsultation instead of face-to-face consultations. Web-based ICT platforms can be used to perform a preliminary assessment of the animal's health and the need for veterinary intervention.

Face-to-face consultations

Face-to-face consultations should be restricted to undeferrable emergencies and must always be arranged in advance by calling the veterinary practice for an appointment, in order to avoid crowding and contact with other individuals and animals in the waiting room. Consultations should take place observing the measures to protect the health and safety of all those involved.

Veterinary professionals should wear usual PPE, unless the animal comes from a household with a suspected or confirmed case of COVID-19. In this case, they should wear PPE appropriate for examining an animal considered as being potentially infected with SARS-CoV-2 (see the section on PPE). It is the duty

of the pet's owner or other member of the family or household to inform the veterinary professional in advance that the animal lives with people with a suspected or confirmed diagnosis of COVID-19. In this case, the veterinary practice should make arrangements for the arrival and examination of the animal, providing dedicated pathways in the waiting and consultation areas, so that the animal does not come into contact with others. All areas, instruments and equipment used must be sanitised at the end of the consultation, using products suited to SARS-CoV-2 decontamination. For veterinary facilities and toilets, it is recommended to use a 0.5% sodium hypochlorite solution (0.1% solutions are considered adequate for domestic use), and 70% ethanol solutions should be used for medical instruments (31-32).

The veterinary professional and any other subjects assisting during consultations or treatment, including the owner or person accompanying the pet, if they help restrain the animal, must wear PPE (see dedicated section) permitting a high level of protection against SARS-CoV-2. PPE must be disposed of, together with any waste, in compliance with the guidelines for correct waste management set forth in ISS COVID-19 Report no. 3/2020 Rev. (Interim guidelines for the management of household waste regarding the transmission of SARS-CoV-2 infection). If no disposable garments are available, clothing should be washed using a commercial detergent on a 90°C cycle for 30 minutes if there is a reasonable suspicion of contamination by secretions and excretions (32). If deemed necessary, pets may be bathed before the consultation. Otherwise, cleansing/ disinfectant pet wipes may be used, providing they have been approved for dermatological use on animals.

House calls

House calls for treatment and diagnostic needs should be avoided as far as is possible. When a house call is absolutely necessary, it must be conducted so as to minimise contacts with members of the household and physical distancing practices must be observed. When entering the home and during the visit, veterinary professionals should wear personal protective equipment suited to the circumstances and take precautionary measures at all times. Any other individuals helping to restrain the pet should also wear PPE. PPE and any equipment used must be disposed of appropriately or stowed away at the end of the visit and cleaned and decontaminated using disinfectants or procedures that are efficacious on SARS-CoV-2.

House calls to households with suspected or confirmed cases of COVID-19

When veterinary professionals make house calls to the homes of people with a suspected or confirmed diagnosis of COVID-19, it is the duty of the pet owner or other carer who requested the visit to inform the veterinary professional in advance. In these cases, veterinary professionals must wear PPE that provides a high level of protection against SARS-CoV-2. Any individuals helping the veterinarian to restrain the animal must wear similar protective equipment. During house calls, individuals with a suspected or confirmed diagnosis of COVID-19 must stay in an area of the home away from the area in which the pet is being examined and must not help the veterinary professional examine the animal.

Hospitalisation of companion animals at the veterinary practice

If it is necessary to hospitalise an animal at the veterinary practice following a consultation or house call, separate areas and specific procedures must be arranged for the accommodation, treatment and care of animals from households with suspected or confirmed cases of COVID-19. In this case, individuals who care for the animal, administer treatments to or perform any other intervention on the animal, and cleaning staff should wear PPE providing a high level of protection against SARS-CoV-2 (see section dedicated to PPE). All areas, instruments and equipment that come into contact with hospitalised animals must be sanitised, as described above for consultations at the veterinary practice. The same applies for the disposal of waste and disposable material.

Conclusion

Although it is essential to continue safeguarding the health of pets, during the COVID-19 epidemic, all non-essential or deferrable movements must be avoided, including travel for veterinary appointments or house calls. Consultations at the veterinary practice and house calls, especially when they involve animals that live in households with suspected or confirmed cases of COVID-19, must be conducted using PPE and procedures that minimise the risk of exposure. When it is necessary to hospitalise animals from households with suspected or confirmed cases of COVID-19, provision must be made to minimise potential risks for staff and any other hospitalised animals.

Travel, transportation and external custody of companion animals

Travel

In the current epidemic scenario, companion animals that share living spaces with humans should be kept inside the home insofar as is possible, whilst respecting the needs typical of the species, and they should only go outdoors to satisfy their day-to-day care needs (or service needs for guide dogs and rescue dogs). This is particularly important for households with suspected or confirmed cases of COVID-19. Pets should only travel for urgent health needs (veterinary care and hospitalisation at veterinary practices).

External custody

If the owner and other members of the household are unable to care for them, companion animals should only leave the home and be entrusted, even temporarily, to external subjects for their care and wellbeing. When animals are entrusted to external custody, it is necessary to consider the risk of SARS-CoV-2 they have been exposed to at home, i.e. their SARS-CoV-2 infection status. It should be considered that entrusting animals that could potentially be infected with SARS-CoV-2 to external subjects implies an albeit remote possibility of transporting animals during the viral shedding phase. Birds, reptiles, amphibians and fish are excluded from these precautions.

The possible alternatives regarding external custody are as follows:

- If a diagnostic test for SARS-CoV-2 is performed, in the presence of a negative result, the animal may be entrusted to any other environment, including other homes, able to guarantee its day-to-day care, health and welfare. Testing should be performed by the Local Health Authority's veterinary services, which will send the samples to an Institute for Research on the Prevention of Animal Diseases.

  It is essential to remember that priority over resources for the diagnosis of SARS-CoV-2 (swabs, reagents, organisational and lab capacity) must be given to human diagnostics.

- In order to safeguard, as a priority and as a precautionary measure, the health of the individuals who provide accommodation for animals, when testing is not possible or appropriate (animals from households in which none of the members are subject to restrictions for COVID-19), pets should be entrusted to other homes (relatives, friends, third parties, etc.) taking into consideration the risk of exposure in the household of origin and the receiving household, in order to avoid transferring animals from higher-risk situations to lower-risk situations (Table 1).

Table 1. Classification of the theoretical risk of exposure to SARS-CoV-2 for companion animals living in homes

Household in which the animal has lived for the past two weeks	Animals' risk of exposure to SARS-CoV-2
No individual subject to specific restrictions #	very low
With at least one individual self-isolating #	low
With at least one person quarantined at home	medium
With at least one suspected, probable or confirmed case* of COVID-19	high
With at least one suspected, probable or confirmed case* of COVID-19, currently hospitalised	
At least one member of the household has died of COVID-19 or an illness with clinical symptoms compatible with COVID-19	
With individuals who have recovered from COVID-19	very low

definition pursuant to Prime Minister's Decree of 8/3/2020
* According to the definition of the ECDC
https://www.ecdc.europa.eu/en/case-definition-and-european-surveillance-human-infection-novel-coronavirus-2019-ncov

- Pets should be entrusted to kennels, catteries, animal shelters and similar facilities following the same risk assessment approach, in order to avoid contact between animals originating from circumstances characterised by different risk levels. The suitability of the animal accommodation facilities must be assessed by the Veterinary Services of the Local Health Authorities and should take into account the biosafety measures to be adopted to protect both staff and animals. The Ministry of Health guidelines specify that pets originating from households with members with a suspected or confirmed case of COVID-19 must be kept in individual and, where possible, segregated cages. When attending to animals' day-to-day care, staff must wear PPE and receive information and training on health and safety compliance (30).

Return home for animals entrusted to external accommodation facilities

When animals return home after a stay in an external accommodation facility, it is necessary to adopt the same SARS-CoV-2 exposure risk analysis approach described above, i.e. confirmation of infection status by diagnostic testing. Animals taken to kennels, catteries, animal shelters or other similar facilities and originating from households with suspected or confirmed cases of COVID-19, should return home or be transferred to their new home, following a negative SARS-CoV-2 test. Otherwise, they should only be transported once the animal has been isolated in the accommodation facility for at least two weeks without presenting any respiratory or gastrointestinal symptoms.

Transportation of companion animals from households with suspected or confirmed cases of COVID-19

Animals may be transported outside the home for urgent veterinary consultations, to be entrusted to external subjects, to return to their home and when pets left at home alone are to be reunited with their owners. In all cases, professional accompanying the animal must wear PPE (see the PPE section). Transport cages and pet carriers must be decontaminated after use (70% ethanol). During transportation, the animal must not be left unattended and must not come into contact with other animals.

Conclusion

Pets may leave their home temporarily only as required to satisfy their welfare and physiological needs (walks) or for emergencies (urgent veterinary care). Animals may only be entrusted to external subjects or facilities when the owner or other family members are unable to attend to their health and welfare. When rehoming animals, it is necessary to consider the risk of SARS-CoV-2 they have been exposed to in the household of origin. When it is possible to perform a diagnostic test, in the presence of a negative result, the animal may be transferred to any environment. Animals that test positive for SARS-CoV-2 infection must be reported to the Local Health Authority, transferred to a dedicated facility and monitored.

It is essential to remember that the resources for the diagnosis of SARS-CoV-2 (swabs, reagents, organisational and lab capacity) must be destined as a priority to human diagnostics.

Management of special activities involving animals: guide dogs, rescue dogs, animals used for therapeutic purposes (pet therapy)

Guide dogs and rescue dogs

The use of guide or rescue dogs originating from households with suspected or confirmed cases of COVID-19 should be considered very carefully, as the strict application of precautionary measures could have critical consequences for the service they have been trained for. This matter requires careful consideration, taking into account factors regarding the animal's living environment, whether it can be cared for safely, its health and the type of activity performed by the animal. Handlers and users must wear PPE that provide a high level of protection even when the epidemiological context is considered to be favourable.

Animals used for pet therapy

According to the national guidelines on pet therapy (IAA) (33), animals used for care purposes (therapy, education, exercise) must be examined regularly and their health must be monitored by their usual veterinary professional. More frequent assessments and more stringent practices may be necessary in special risk situations. In the current COVID-19 scenario, veterinarians and handlers should make sure that the animals involved in pet therapy activities do not come from environments with a risk of SARS-CoV-2. As for guide dogs and rescue dogs, once again, the use of animals originating from households with suspected or confirmed cases of COVID-19 should be considered very carefully and, where possible, avoided. Pet therapy activities must be planned with special care. It is, in any case, essential to consider the risk associated with exposure to SARS-CoV-2 for the animals and individuals involved, and appropriate PPE should be used.

Use of PPE

Correct use of PPE reduces the risk of exposure to SARS-CoV-2 and, together with physical distancing practices, represents one of the mainstays of the current COVID-19 containment strategy. ISS COVID-19 Report no. 2/2020 Rev. provides guidance on the most appropriate PPE for healthcare professionals working in the various settings, following a risk analysis-based approach.

Also in veterinary and pet care settings, PPE should be chosen by considering a number of different factors:

- whether the animal lives in a household with a suspected or confirmed case of COVID-19;

- the duration and level of contact between the professional and the animal. SARS-CoV-2 is transmitted through droplets and contact. For humans, close (<1 metre) and prolonged (>15 min) contacts are considered to involve a greater risk. Day-to-day care, transportation, veterinary care and the administration of treatments imply varying levels of contact with the animals. Certain procedures entail a risk of generating splashes, droplets and aerosols (e.g. intubation and use of anaesthetic gases for surgery, rhinoscopies and bronchoscopies, performance of nasal swab tests, etc.);
- whether the animal has respiratory or gastrointestinal symptoms and a medical history suggesting contact with humans who have tested positive for SARS-CoV-2.

As a general rule, the guidance regarding the PPE to be used in veterinary practices is similar to the approach based on the risk of exposure for humans; however, it is important to bear in mind a number of important differences between the veterinary setting and that of human medicine:

- There have never been any reports of animals transmitting SARS-CoV-2 to humans in the current COVID-19 scenario. However, PPE should be used as a precautionary measure.
- The use of PPE when handling and managing companion animals is always a good biosafety practice, in that it protects human and animal health from the many zoonotic pathogens and hazards (e.g. antibiotic-resistance) that humans and animals are mutually exposed to, especially in the home. Given the current COVID-19 emergency, as a precaution, these measures should be stepped up, given the risk represented by animals that live with suspected or confirmed cases of COVID-19 and could therefore contract the infection and in turn shed the virus.
- The containment of droplets through the use of facemasks, a practice that is considered to be efficacious in preventing SARS-CoV-2 infection, especially by symptomatic subjects, is not possible in animals. Animals can sneeze or cough suddenly, thereby releasing into the air droplets and secretions that could remain on the animal's coat or reach nearby people. This occurrence also depends on the quantity of droplets and other material released, which in turn depends primarily on the size and species of the animal.

The biological samples of animals with a suspected or confirmed diagnosis of SARS-CoV-2 must be processed and analysed in the same way as human samples, following WHO guidelines (34). These guidelines specify that diagnostic activities that do not entail the propagation of the virus (e.g. molecular tests, sequencing) may also be performed in facilities and using procedures that meet BSL2 requirements. Activities involving the propagation of the virus (e.g. isolation or culture of the virus, neutralisation assays) must be performed in laboratories meeting BSL3 containment requirements. Laboratory staff must be appropriately trained, must work in compliance with good microbiological laboratory practices and must wear PPE.

Staff must have received appropriate information and training regarding the correct use of PPE (including clothing procedures and safe processing and disposal) and must know how to choose the type of protection best suited to the setting in which they operate. By way of an example, Tables 2 and 3 provide suggestions regarding the most common pet care and treatment situations.

Conclusion

PPE are a fundamental form of protection against infectious agents and, in the current epidemic setting, they constitute one of the mainstays of the SARS-CoV-2 containment strategy.

When choosing the most suitable PPE, owners, volunteers, veterinary professionals, etc. should be guided by risk analysis that takes into account the health of the animal, the operational setting and the type of activity performed.

Table 2. Suggestions for the use of personal protective equipment (PPE) by pet owners and other subjects who care for and treat animals during the COVID-19 epidemic

Description of the activity	Subjects involved	Dogs, cats, ferrets and other mammals	
		who LIVE WITH individuals with suspected or confirmed COVID-19	who DO NOT LIVE WITH individuals with suspected or confirmed COVID-19
Pet care in the home			
Feeding and cleaning of equipment in the absence of animals	- owners, family and household members	- disposable gloves	- disposable gloves
Cleaning of litter trays, beds, etc.		- gloves and surgical mask	- disposable gloves
Grooming		- gloves and surgical mask	- disposable gloves
Pet care outside the home			
Dog-walking	- owners, family and household members - external helpers	- gloves and FFP2 facemasks	- disposable gloves*
Veterinary care at the home			
House calls by veterinary professionals; Administration of veterinary treatments	- veterinary professionals and veterinary nurses - owners and family and household members helping to restrain the animal or administer treatments	- FFP2 facemask; - gloves; - shoe covers; - disposable gown; disposable hair cap; - safety glasses/goggles/face shield	- gloves, surgical facemask and any other PPE usually used when working;
Transportation of animals			
With a pet carrier or transportation cage	- owners, family and household members - external helpers	- gloves and FFP2 facemasks; - shoe covers	- disposable gloves*
Without a pet carrier	- owners, family and household members - external helpers	- gloves and FFP2 facemasks; - disposable gown/ disposable overall; - glasses - shoe covers	- disposable gloves*
Consultations at the veterinary practice			
Outpatient and specialist consultations; Instrumental diagnostic procedures; Nasal/oropharyngeal/rectal swabs; Surgery	- veterinary professionals, veterinary nurses; - owners or other persons helping to restrain the animal	- gloves and FFP2 facemasks; - gloves; - disposable gown; disposable hair cap; - shoe covers - safety glasses/ face shield	- gloves, surgical facemask and any other PPE usually used when working;
Procedures or settings entailing a risk of aerosols (e.g. dental care)	- veterinary professionals and veterinary nurses	- FFP3 facemask or, when not available, FFP2 facemask; - gloves; - disposable gown; disposable hair cap; - shoe covers - safety glasses/goggles/face shield	
Grooming/bathing before the consultation or during hospitalisation cleaning of accommodation in the presence of animals	- veterinary nurses; - cleaning staff	- FFP2 facemask; - disposable gown; disposable hair cap; - work boots or closed footwear - heavy-duty gloves; - glasses	- gloves and surgical mask
Cleaning of accommodation in the absence of animals	- veterinary nurses; - cleaning staff	- gloves and FFP2 facemasks - shoe covers	- gloves and surgical mask

* this does not take into consideration any obligations deriving from national or local regulations concerning the use of facemasks outside of the home

Table 3. Suggestions regarding the use of personal protective equipment (PPE) by those who process and analyse samples from companion animals (dogs, cats, ferrets, hamsters and other mammals)

Description of the activity	Subjects involved	Biological samples from animals with a suspected or confirmed diagnosis of SARS-CoV-2 infection	Biological samples from animals	
			who LIVE WITH individuals with suspected or confirmed COVID-19	who DO NOT LIVE WITH individuals with suspected or confirmed COVID-19
Laboratory tests				
Processing of biological samples for diagnostic tests	- veterinary professionals; biologists, biotechnologists; - researchers; - analysts, lab technicians	- disposable gloves; - disposable gown; - disposable hair cap; - disposable FFP2/FFP3 facemask; - disposable shoe covers; - eye protection (glasses or face shield);	- disposable gloves; - disposable gown; - disposable hair cap; - disposable FFP2/FFP3 facemask; - disposable shoe covers; - eye protection (glasses or face shield);	- disposable gloves; - surgical mask; - any other PPE usually used when working

Clinical monitoring of companion animals for SARS-CoV-2

Clinical monitoring of animals for SARS-CoV-2

Those caring for animals that have been in or come from households with suspected or confirmed cases of COVID-19 should pay special attention to the clinical conditions of the animals, in particular the presence of respiratory and gastrointestinal symptoms (breathing difficulties, cough, vomiting, diarrhoea, loss of appetite, fever).

Owners who notice these symptoms, should contact their vet as soon as possible. The veterinary professional should perform a diagnostic work-up, including lab tests and instrumental procedures, in order to establish the cause of the symptoms, considering the medical conditions typical of the species and breed in question.

Cases of disease for which differential diagnoses compatible with the animal's clinical symptoms have been ruled out should be reported to the veterinary service of the competent Local Health Authority and, where appropriate, samples should be collected and lab tests for SARS-CoV-2 performed.

When samples are sent to a laboratory authorised to perform SAR-CoV-2 tests or other facility, the laboratory must be informed as to whether the samples come from an animal that lives with a suspected or confirmed case of COVID-19.

Post-mortem monitoring for SARS-CoV-2

In households with suspected or confirmed cases of COVID-19, companion animals that die for any reason should be reported by the owner, carer or veterinary professional to the veterinary services of the Local Health Authority and sent to the nearest Istituto Zooprofilattico Sperimentale - Institute for Research on the Prevention of Animal Diseases - for the appropriate diagnostic procedures, including SARS-CoV-2 testing.

Collection of samples for the diagnosis of SARS-CoV-2 in companion animals

Sampling for SARS-CoV-2 tests in companion animals should preferably include nasal, pharyngeal and rectal tests. Samples can be collected using the same swabs in transport medium as used for human tests. In addition to these media, the acquisition of blood samples makes it possible to perform investigations that

are useful for seroepidemiological studies and to investigate whether the animal has undergone seroconversion. For the serological tests, blood samples should be collected without anticoagulant. Staff performing sample collection must wear suitable PPE. The samples must be sent to the Istituto Zooprofilattico Sperimentale - Institute for Research on the Prevention of Animal Diseases - or other laboratory authorised to process SARS-CoV-2 tests.

SARS-CoV-2 diagnostic tests in companion animals

The Istituti Zooprofilattici Sperimentali - Institutes for Research on the Prevention of Animal Disease - and other laboratories authorised to perform SARS-CoV-2 tests in animals should use validated assay methods. According to current knowledge, molecular real-time polymerase chain reaction (RT-PCR) assays that allow the detection of the viral genome should be considered the gold standard for the diagnosis of SARS-CoV-2 infection, by virtue of the method's sensitivity, specificity and turnaround time. The Italian Ministry of Health has approved a number of kits for the diagnosis of COVID-19 in humans (35).

When this report was drawn up, none of these kits had been formally validated for use in the veterinary setting. However, the comparison between the sequences of the coronaviruses specific to animals would tend to exclude the possible cross-reactivity of the molecular tests for SARS-CoV-2 with the coronavirus strains that are commonly found in companion animals. The laboratories that process the tests should therefore complement the tests conducted by the kit manufacturer with further tests in order to define the validity of the method in this new field of application and evaluate the specificity of the assay for animal coronaviruses.

Accompanying medical history and clinical information

The biological samples taken from animals and sent to authorised laboratories to undergo diagnostic testing for SARS-CoV-2 should be accompanied by the following information:

- General particulars of the animal (species, breed, age).
- The address of the household where the animal is kept.
- Reason for the request: i) definition of infection status for the purpose of entrusting the animal to a third party; ii) clinical suspicion in an animal living with suspected or confirmed cases of COVID-19; iii) deceased animal from a household with suspected or confirmed cases of COVID-19; iv) other reasons (e.g. follow-up for an animal that previously tested positive for SARS-CoV-2).
- If the animal presented clinical symptoms when the sample was collected, a brief description of the symptoms should be provided.

Animals with a positive SARS-CoV-2 test result

Authorised test laboratories must promptly report any cases of positivity for SARS-CoV-2 to the Local Health Authority, the competent Regional or Autonomous Provincial Authority, the Ministry of Health's General Directorate for Animal Health and Veterinary Medicines and the National Institute for Health. Animals with positive diagnostic test results must be isolated in a dedicated facility, their clinical status must be regularly monitored and the diagnostic test must be repeated until the complete remission of any clinical symptoms and until a double-negative result is obtained (two consecutive assays performed 24/48 hours apart). In households with suspected or confirmed cases of COVID-19, the possibility of keeping the positive animal at home may be considered, provided the animal can be confined and cared for in such a way as to ensure that it does not come into contact with other animals or humans in the household.

Conclusion

Those caring for animals in households with suspected or confirmed cases of COVID-19 should pay special attention to the onset of any respiratory and gastrointestinal symptoms (breathing difficulties, cough, vomiting, diarrhoea, loss of appetite, fever) the animals may experience. Owners who notice these symptoms, should contact their vet by telephone as soon as possible. Cases of illness for which differential diagnoses compatible with the animal's clinical status have been ruled out should be reported to the veterinary service of the competent Local Health Authority and, where appropriate, tests for SARS-CoV-2 should be performed by an authorised laboratory. Animals that die in households with suspected or confirmed cases of COVID-19 should be reported to the veterinary services of the Local Health Authority and sent to the nearest Institute for Research on the Prevention of Animal Disease for the appropriate diagnostic procedures. Animals that test positive for SARS-CoV-2 should be reported to the veterinary service of the Local Health Authority and be isolated in a suitable dedicated facility until fully recovered. In households with suspected or confirmed cases of COVID-19, the possibility of keeping the positive animal at home may be considered, provided it is possible to guarantee living conditions such as to effectively limit the positive animal's contact with other animals or humans in the household.

A look at the rest of the world: guidelines issued by the competent national and international agencies regarding pet care during the COVID-19 epidemic

Several national and international agencies, scientific and cultural societies and associations operating in the veterinary public health, animal health and veterinary care sector have recently dealt with the issue of the management of companion animals during the COVID-19 epidemic and issued guidelines for owners, veterinary professionals and other subjects who attend to the welfare and health of pets. This information is made available online in their respective websites and is periodically updated.

Italian Ministry of Health

- *Emergenza COVID-19. Linee guida per la gestione di animali da compagnia sospetti di infezione*
- *Animali d'affezione e Coronavirus*

World Organisation for Animal Health (OIE)

- Questions and Answers on the 2019 Coronavirus Disease (COVID-19)

World Health Organization (WHO)

- Q&A on coronaviruses (COVID-19)

Food and Agriculture Organization of the United Nations (FAO)

- Novel Coronavirus (COVID-19)

Agence fédérale pour la sécurité de la chaîne alimentaire (AFSCA) - Belgium

- Questions sur le coronavirus?

American Veterinary Medical Association (AVMA)

- COVID-19: FAQs for pet owners
- Interim recommendations for intake of companion animals from households where humans with COVID-19 are present
- What veterinarians need to know

Associazione Nazionale Medici Veterinari Italiani (ANMVI)

- Press releases

Australian Veterinary Association (AVA)

- Pets of COVID-19 positive/at-risk humans

British Veterinary Association (BVA)

- Coronavirus disease (Covid-19) – updates for the veterinary profession

Federation of European Companion Animal Veterinary Associations (FECAVA)

- Advice for pet owners for visiting your vet during the COVID-19 outbreak

Federation of Veterinarians of Europe (FVE)

- COVID-19 and the veterinary profession

Federazione Nazionale Ordini Veterinari Italiani (FNOVI)

- Emergenza COVID-19 – Ulteriori indicazioni per i medici veterinari

Government of Canada

- Animal Health and COVID-19

Istituto Zooprofilattico Sperimentale delle Venezie

- *Nuovo Coronavirus e animali da compagnia: domande frequenti e informazioni utili*

Society for the Prevention of Cruelty to Animals (SPCA), Hong Kong Veterinary Association (HKVA) and Journal Club College of Veterinary Medicine and Life Sciences

- SPCA (HK), HKVA and City University Veterinary Professionals remind pet owners of their commitments and responsibilities to their pets in these trying times

Società Italiana delle Scienze Veterinarie (SISVET)

- *Covid-19 e animali da compagnia*

Società Italiana di Medicina Veterinaria Preventiva (SIMeVeP)

- *La Sanità Pubblica Veterinaria nell'emergenza COVID-19*

United Kingdom Department for Environment, Food and Rural Affairs and Animal and Plant Health Agency (UK)

- Coronavirus (COVID-19): advice for people with animals

World Small Animal Veterinary Association (WSAVA)

- COVID-19 – Advice and resources
- The new coronavirus and companion animals - advice for WSAVA members

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Annex. Companion animals, advice for safe day-to-day care

Companion animals: advice for safe day-to-day care

Advice on how to attend to your pet's welfare and health

- Spend time with your pet, it will help keep both you and your pet healthy.
- Always wash your hands with soap and water or use an alcohol rub before and after contact with your pet and when cleaning pet beds, litter trays and feed bowls.
- Do not wash your animal more often than usual and when you do, use only products with a neutral pH or recommended by your vet. When returning for a walk, you may clean your pet's coat, paw and anal/genital area using water and products with a neutral pH or that are approved for dermatological use on animals.

If you suspect you have or might have COVID-19 or quarantined

- Limit contact with your pet that should not be removed from home. Ask another family member to care for your pet.
- Get help from external people (friends, relatives, volunteers) only if necessary and notify them in advance of your health.
- If you are the only person who can take care of the animal, use the mask and gloves.
- Your pet litter must be disposed of with undifferentiated waste.
- Avoid your cat's exits and limit your dog's ones as much as possible.

If you help to look after pets

- Find out whether the animal lives with people with a confirmed or suspected diagnosis of COVID-19 and, if so, avoid letting it into your home, where possible.
- When walking the animals, you look after, observe physical distancing, use personal protective equipment and find out how to use it correctly.
- Do not exercise more than one animal at a time, except in the case of animals from the same household. Always use a leash and never leave animals unattended.

Make sure your animals are in good healthy conditions

- The welfare of our animals is important for them and for us. If you are unsure about your pet's health, call your vet and follow his directions.
- Treat your animals only with medication prescribed by your vet. Do not buy and do not give unauthorized drugs to your pets, to protect them against SARS-CoV-2.

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For further information consult:
Rapporto ISS-COVID-19 n. 16/2020 – English version
Companion animals and SARS-CoV-2: what do we need to know, how should we behave?

Rapporti ISS COVID-19 (ISS COVID-19 Reports)

ISS COVID-19 Reports are mainly addressed to healthcare professionals to cope with different aspects of the COVID pandemic. They provide essential and urgent directions for emergency management and are subject to updates. All reports have an English abstract.

The complete list is available at **https://www.iss.it/rapporti-covid-19**.

Some reports (highlighted below) are also translated in English and are available at **https://www.iss.it/rapporti-iss-covid-19-in-english**

1. Gruppo di lavoro ISS Prevenzione e controllo delle Infezioni. *Indicazioni ad interim per l'effettuazione dell'isolamento e della assistenza sanitaria domiciliare nell'attuale contesto COVID-19.* Versione del 24 luglio 2020. Roma: Istituto Superiore di Sanità; 2020 (Rapporto ISS COVID-19, n. 1/2020 Rev.)
2. Gruppo di lavoro ISS Prevenzione e controllo delle Infezioni. *Indicazioni* ad interim *per un utilizzo razionale delle protezioni per infezione da SARS-CoV-2 nelle attività sanitarie e sociosanitarie (assistenza a soggetti affetti da COVID-19) nell'attuale scenario emergenziale SARS-CoV-2.* Versione del 10 maggio 2020. Roma: Istituto Superiore di Sanità; 2020 (Rapporto ISS COVID-19, n. 2/2020 Rev. 2)
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10. Gruppo di Lavoro ISS Ambiente-Rifiuti COVID-19. *Indicazioni ad interim su acqua e servizi igienici in relazione alla diffusione del virus SARS-CoV-2 Versione del 7 aprile 2020.* Roma: Istituto Superiore di Sanità; 2020. (Rapporto ISS COVID-19, n. 10/2020).
11. Gruppo di Lavoro ISS Diagnostica e sorveglianza microbiologica COVID-19: aspetti di analisi molecolare e sierologica *Raccomandazioni per il corretto prelievo, conservazione e analisi sul tampone oro/rino-faringeo per la diagnosi di COVID-19. Versione del 17 aprile 2020.* Roma: Istituto Superiore di Sanità; 2020. (Rapporto ISS COVID-19, n. 11/2020).

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20. Gruppo di Lavoro ISS Prevenzione e Controllo delle Infezioni. *Indicazioni ad interim per la sanificazione degli ambienti interni nel contesto sanitario e assistenziale per prevenire la trasmissione di SARS-CoV 2. Versione del 14 maggio 2020.* Roma: Istituto Superiore di Sanità; 2020. (Rapporto ISS COVID-19, n. 20/2020 Rev.).

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