

# Questionnaire-based survey on parvovirus infection and possible creation of a surveillance system for infectious diseases in the dog and cat



Canine parvovirus and feline panleukopenia are highly contagious and often fatal diseases reported worldwide and caused respectively by canine parvovirus type 2 (CPV-2), including its three variants (CPV-2a, 2b, 2c), and feline parvovirus (FPV). Even in subjects vaccinated against these infections, the occurrence of the infection is frequent. No surveillance system for these infections exists in Italy.

Aim of the present work was to validate a questionnaire used to conduct a survey to collect the opinion of Vets with regards to: a) risk factors for these infections; b) severity of these infections in the dog and cat; c) control measures applied; e) diagnostic techniques used. Finally, the questionnaire investigated the inclination of Vets to participate in the creation of an information surveillance system for parvovirus infections in dogs and cats. The questionnaire was administered to 32 Vets of Central Italy. The preliminary results of the survey were analyzed.

The critical points identified were the identification of risk factors, the diagnostic approach and the prevention of parvovirus infections. The majority of Vets declared to be interested in the establishment of a surveillance system for these infections.

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## INTRODUCTION

Canine parvovirus type 2 (CPV-2) and feline parvovirus (FPV) belong to the family *Parvoviridae*, subfamily *Parvovirinae*, and are included in the species *Carnivore protoparvovirus 1*, together with mink enteritis virus (MEV) and raccoon parvovirus (RPV).<sup>1</sup> Widely spread worldwide, these viruses are often responsible for outbreaks of high morbidity and mortality, especially in densely populated areas. CPV-2 is the aetiological agent of canine parvovirus, a highly contagious infectious disease of domestic and wild canids. Commonly known in the dog as 'haemorrhagic gastroenteritis', canine parvovirus infection is more severe in puppies aged 4-12 weeks, which are infected in the absence of specific immunity or when maternal derived antibody titres (MDA) fall below the threshold of protection.<sup>2</sup> CPV-2 is a continuously evolving virus: it initially appeared in Europe and North America in the late 1970s and in the following decades it was completely replaced by the new antigenic variants CPV-2a, 2b and 2c, which are now variously distributed throughout the world and which, compared to the original strain, have regained the ability to replicate *in vivo* in the feline population.<sup>2-4</sup> FPV, which was first discovered in 1920, is the aetiological agent of feline panleukopenia, a contagious infectious disease which affects domestic and wild felids, causing depression, gastroenteritis, panleukopenia, nervous system symptoms and a high mortality rate among young subjects without specific immunity.

**Despite vaccination, parvovirus is an endemic, highly contagious and lethal disease worldwide.**

CPV-2 and FPV are small, spherical, non-enveloped viruses displaying icosahedral symmetry and with a genome consisting of a single molecule of linear DNA.<sup>1</sup> The control strategies which are commonly used to limit the spread of CPV-2 and FPV in the canine and feline population are often ineffective precisely because of the biological and structural characteristics of these viruses. In fact, the absence of an envelope makes these viruses extremely resistant to environmental disinfectants and facilitates the indirect transmission of the infection through contact with contaminated fomites.

Recent necropsy studies on the causes of death in dogs in Central Italy have shown that parvovirus infections are a frequent cause of death.<sup>5,6</sup>

Aim of the present work was to conduct an epidemiological survey, based on classical survey methodology and through the elaboration and validation of a questionnaire addressed to veterinarians, in order to assess existing critical points in the prevention and management of parvovirus infections in the dog and cat. The study assessed the way in which anamnestic data was

collected, the preventive measures undertaken and the diagnostic techniques used in case of suspected cases of infection. In addition, a specific section of the questionnaire assessed the potential availability of the responding veterinarian to participate in the creation of an information system for parvovirus infection or for other infectious diseases of the dog and cat.

## MATERIALS AND METHODS

The questionnaire was prepared and evaluated by 4 experts in epidemiology and infectious diseases of small animals and was then modified on the basis of the comments received. The next step was to administer the questionnaire to 4 clinical veterinarians in order to assess the clarity of the questions (pilot study). The questionnaire was structured in 5 sections with 39 multiple-choice and 3 open-ended questions (additional material), for a total of 42 questions (Q).

The first part (Q. 1-5) was used to define the geographical location and type of veterinary facilities involved, as well as the age and role of the veterinarians being surveyed. The second part (Q. 6-15) was used to verify how the clinical history is collected and what is the parvovirus vaccination protocol used. Specifically, this section focused on infection risk management, i.e. the importance that veterinarians attribute to information regarding the origin (Q. 6), environment and lifestyle (Q. 7) and vaccination status (Q. 8) of their patients when planning interventions for the containment and prevention of the disease. Also investigated were: the propensity to inform clients of possible vaccine adverse reactions (Q. 9); the criteria used in the selection of a vaccination protocol (Q. 10-11); the inclination to use prevaccination serological tests that reveal the MDA titre for parvovirus (Q. 12-13); the level of awareness of parvovirus infection epidemiology in their territory (Q. 14); the ability to systematically record the causes of death, with the hypothesis of using this database for the epidemiological control of parvovirus infections (Q. 15).

The third part of the questionnaire (Q. 16-19) examined the efficacy of the biosecurity measures implemented by the veterinary facility when parvovirus cases are suspected and/or detected, in order to avoid the transmission of the infection to other visiting or hospitalized patients. The questions of this section allowed to ascertain: the eventual presence, in the veterinary facility, of an isolation area for infectious animals (Q. 16) and, if yes, of a further area dedicated exclusively for patients infected with parvovirus (Q. 17); the products used for environmental disinfection (Q. 18); the possible occurrence of nosocomial infections within the veterinary facility (Q. 19). The fourth part (Q. 20-35) evaluated the diagnostic approach used in case of clinical suspicion of parvovirus infection. The initial questions focused on the approx-

imate number of cases of infection recorded annually within the facility in the dog (Q. 20) and cat (Q. 21), as well as the mortality rate attributed to the infection in the two species (Q. 22-23). The next question (Q. 24) investigated whether multi-vet facilities shared a common diagnostic protocol. The questionnaire then assessed the frequency of use of diagnostic tests to confirm the clinical suspicion of infection in the dog (Q. 25) and cat (Q. 26) and the type of tests used (Q. 27-28). Questions 29 and 30 assessed whether the cost of diagnostic tests could be an obstacle to their use. With regard to differential diagnoses, questions were asked on whether parvovirus is suspected in the dog (Q. 31) and cat (Q. 32) even in the absence of diarrhoea, whether subclinical and/or asymptomatic infections were ever observed in the two species (Q. 33) and whether cat parvovirus is also investigated in cases of hyperacute death (Q. 34) or suspected poisoning (Q. 35).

The last part of the questionnaire (Q. 36-40) was used to assess the potential interest of veterinarians in creating a notification system for infectious diseases of small animals. It ascertained the potential interest of clients for this type of service (Q. 38-39) and the respondents were then asked to select the infectious diseases of the dog and cat to be included within such a system (Q. 40).

**The reasons for the continued presence of the virus must be investigated and identified and the appropriate control measures must be undertaken.**

The last two questions of the survey (Q. 41-42) aimed to understand the level of satisfaction with the questionnaire with regard to its clarity, length and usefulness and finally asked Vets to express any additional personal comments they might have.

The questionnaire was accompanied by a cover letter explaining the aim of the work and the guarantee of anonymity. A total of 75 copies of the questionnaire were made, distributed in the period April-June 2015 and collected by the end of October 2015. Thirty-five copies of the questionnaire were distributed, completed and returned directly at the Department of Veterinary Medicine (DiMedVet) of the University of Perugia; 40 copies were distributed - with the possibility of deferred return during a subsequent visit - at the reception of the Istituto Zooprofilattico Sperimentale dell'Umbria e delle Marche (IZS). The questionnaire was presented to veterinarians dealing with small animals coming to the aforementioned centres; in case of acceptance, the questionnaire was handed out and completed individually. The answers obtained from the survey were subsequently analyzed to evaluate the data obtained.

## RESULTS

The questionnaire was completed and returned by 32 out of 75 polled veterinarians. The response rate (42.6%) can be considered good for the presentation modality used.<sup>7</sup>

**The questionnaire shows that Vets do little to investigate the risk factors of infection related to individual subjects.**

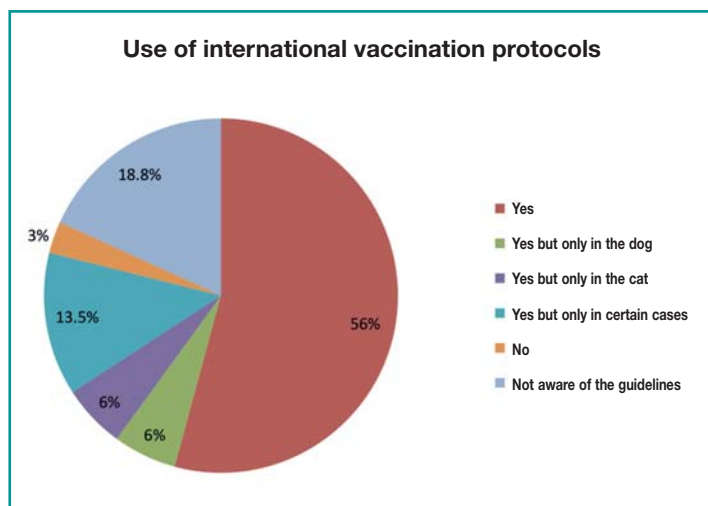
### Type of veterinary facility and role of the respondent veterinarian (Q. 1-5)

All respondent veterinarians work in Central Italy; 27 out of 32 (84%) work in private facilities and 16% in public services. Specifically, 53% work in a multi-vet clinic, 38% in an outpatient clinical practice and 9% are employed in hospitals, kennels/catteries or in "other types of facilities", such as Municipal dog pounds. With regard to their assignment within the facility, 41.6% are employees, 37.5% are the owner, 12.5% are Health Officers and 9.4% are trainees or other. Finally, 47% are between 36 and 45 years old, 25% are between 46 and 55, 22% are under 35 and 6% are over 55.

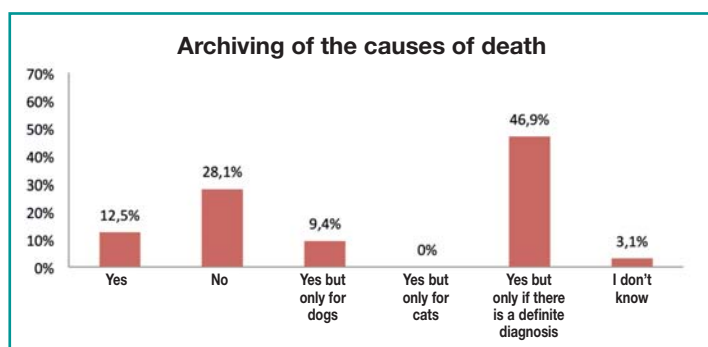
### Clinical history and data collection (Q. 6-15)

Concerning the origin of the animals, 31% of the veterinarians interviewed believe that the information received from the client is always exhaustive, 66% claim to be informed only some of the times and 3% never. Some 14.3% of the Vets regularly inform themselves about the animal's environment and lifestyle, 75% say they inform themselves only occasionally, 7.1% never do so and another 3.6% do not consider useful discussing this topic with the owner.

All the respondents instead agree that it is important to know the vaccination status of the patient. About 97% of Vets explain to the owner the risks and benefits of vaccination and 81% say they are informed about the existence of vaccination guidelines for dogs and cats drawn up by international veterinary medical associations. However, among these, the percentage of Vets who always comply with the recommended protocols drops to 67% (i.e. 56% of respondents), while 15% adopts them only sometimes and 7% only in the dog or only in the cat (Figure 1). With regard to prevaccination serological screening, to be used in puppies to titrate colostral antibodies against parvovirus, 43% of respondents do not consider it necessary as they believe they adopt a vaccination protocol that effectively overcomes the interference of colostral antibodies and 28% do not consider them useful as they have never experienced vaccination incidents. Only 18% consider serology tests useful, while

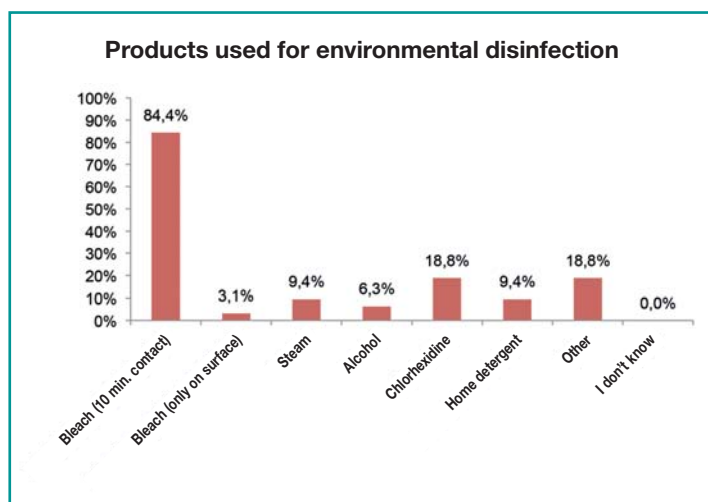


**Figure 1** - Percentage of veterinarians adopting vaccination protocols recommended by international guidelines.



**Figure 2** - Percentage of veterinarians who record the causes of death in their facility.

**Veterinarians are aware of international vaccination guidelines but apply them only in a small percentage of cases.**



**Figure 3** - Products used by respondents for environmental disinfection against parvovirus.

for the remaining 11% the usefulness is limited to only a few cases. Even among those who consider them useful, 35.7% say they do not use them as the methodology is too laborious, 28.6% use them only if the owner is willing to pay for them, 14.3% use them only in subjects at high risk of infection and 21.4% rarely use them. As regards the collection of epidemiological data, 61% of respondents believe to know the epidemiology of parvovirus in their territory; 12.5% systematically record all observed deaths, 47% only do so for cases in which the diagnosis has been confirmed and 9% only those of dogs. Finally, 28% of respondents do not use any recording system (Figure 2).

**Veterinarians generally do use appropriate parvovirus disinfection protocols (sodium hypochlorite left to act for 10 minutes, steam or specific hospital disinfectants).**

### Prevention (Q. 16-19)

A total of 62.5% of respondents claim to have an in-patient ward for infectious diseases and, among these, 81% have a dedicated space for the isolation of subjects suspected of parvovirus infection; 37.5%, on the other hand, do not have a dedicated space for infectious diseases.

Figure 3 lists the main products used for environmental disinfection, used alone and/or in combination, and also indicates the percentage of Vets who use them. Bleach, used in the proper way (1:30 dilution and left to act for at least 10 minutes),<sup>8</sup> was found to be the most widely used product. Only a few Vets reported using other types of disinfectants, which, although not very effective against parvovirus, were still often associated with the use of steam and/or bleach.

More than half of respondents (59%) stated to have at least once suspected that one of their animals had become infected with parvovirus within their veterinary facility.

### Diagnostic approach used in case of suspected parvovirus infection (Q. 20-35)

The average number of cases of infection recorded was of 12.28 cases/year in the dog and 9.66 cases/year in the cat. The mortality attributed to the infection in the two species is shown in Figure 4. Among veterinarians working in multi-vet facilities, 84.5% say they share a common diagnostic protocol. In the dog, 47% of respondents say they confirm the clinical suspicion of parvovirus using laboratory tests and/or rapid in-house test kits, while 44% claim to do so occasionally and 9% say they don't do it. In the cat, the percentage of vets who sys-



### Veterinarians probably underdiagnose paucisymptomatic or atypical cases of parvovirus, particularly in cats.

tematically confirm the clinical diagnosis drops to 37.5%, while 50% use the tests occasionally and 12.5% never use them. The diagnostic tests used and the percentage of veterinarians who use them in the dog and cat are shown in Figure 5. Since more than one response could be ticked, in the dog the most commonly used diagnostic test combinations were haematobiochemical profile and rapid tests (15.6%), clinical signs and haematobiochemical profile (12.5%), haematobiochemical profile and biomolecular tests (9%); in the cat the association between haematobiochemical profile and biomolecular tests (15.6%) and clinical signs and haematobiochemical profile (9.4%). Rapid in-house tests were used by 43.8% of respondents in the dog and by 28.1% in the cat. Only 40.6% of respondents use biomolecular methods in both the dog and the cat. For 50% of respondents the cost of tests is considered an obstacle to their use; for 40.6% it is a limit only occasionally; for 9% it is not a problem. For 34.4% of respondents at least on one occasion they had to personally bear the costs of the confirmatory test, feeling the need to confirm the diagnosis. When asked whether parvovirus is included among the differential diagnoses for diseases in which diarrhoea is not present, 50% of respondents said yes in the dog and 68.8% in the cat. In addition, 47% of respondents said they had never observed cases of sub-clinical/asymptomatic parvovirus infections; 31% said they had seen them in both the dog and the cat, while 12.5% and 9% reported to have seen them in only the dog or in only the cat, respectively. A total of 50% of respondents suspect the presence of parvovirus in all cases of sudden cat death, 28% only occasionally and 22% do not consider it at all. In suspected cases of poisoning, 43.8% of Vets include panleukopenia among the differential diagnoses, 28.1% do so only occasionally and the remaining 28.1% never do so.

### Creation of a notification system for infectious diseases of the dog and cat (Q. 36-40)

Some 91% of respondents declared to consider useful the creation of a notification system that could allow to track the distribution and trends of infectious diseases in the dog and cat population of their territory. Only 9% were uncertain about the usefulness of such a system. In addition, 59% of respondents were willing to actively participate in the system, reporting the cases of infection registered in their facility; 25% would only do so if it didn't take up too much time and 16% were not sure they would participate. A total of 47% of respondents

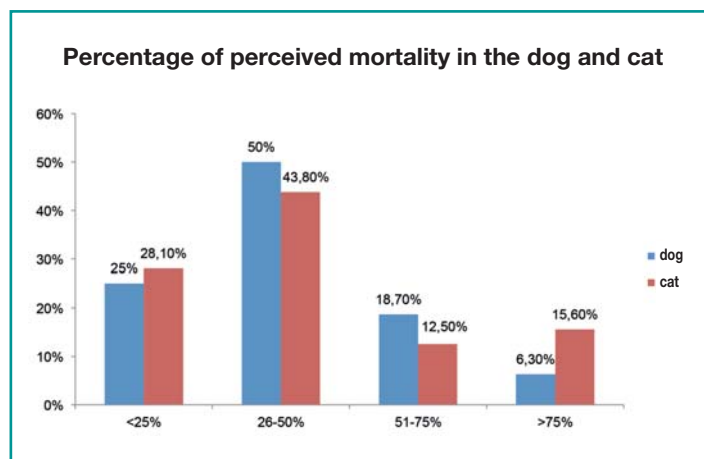


Figure 4 - Mortality rates attributed by responding veterinarians to parvovirus in the dog and cat.

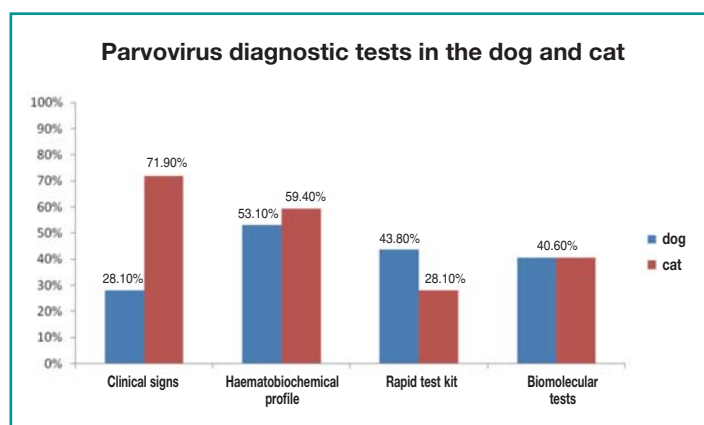
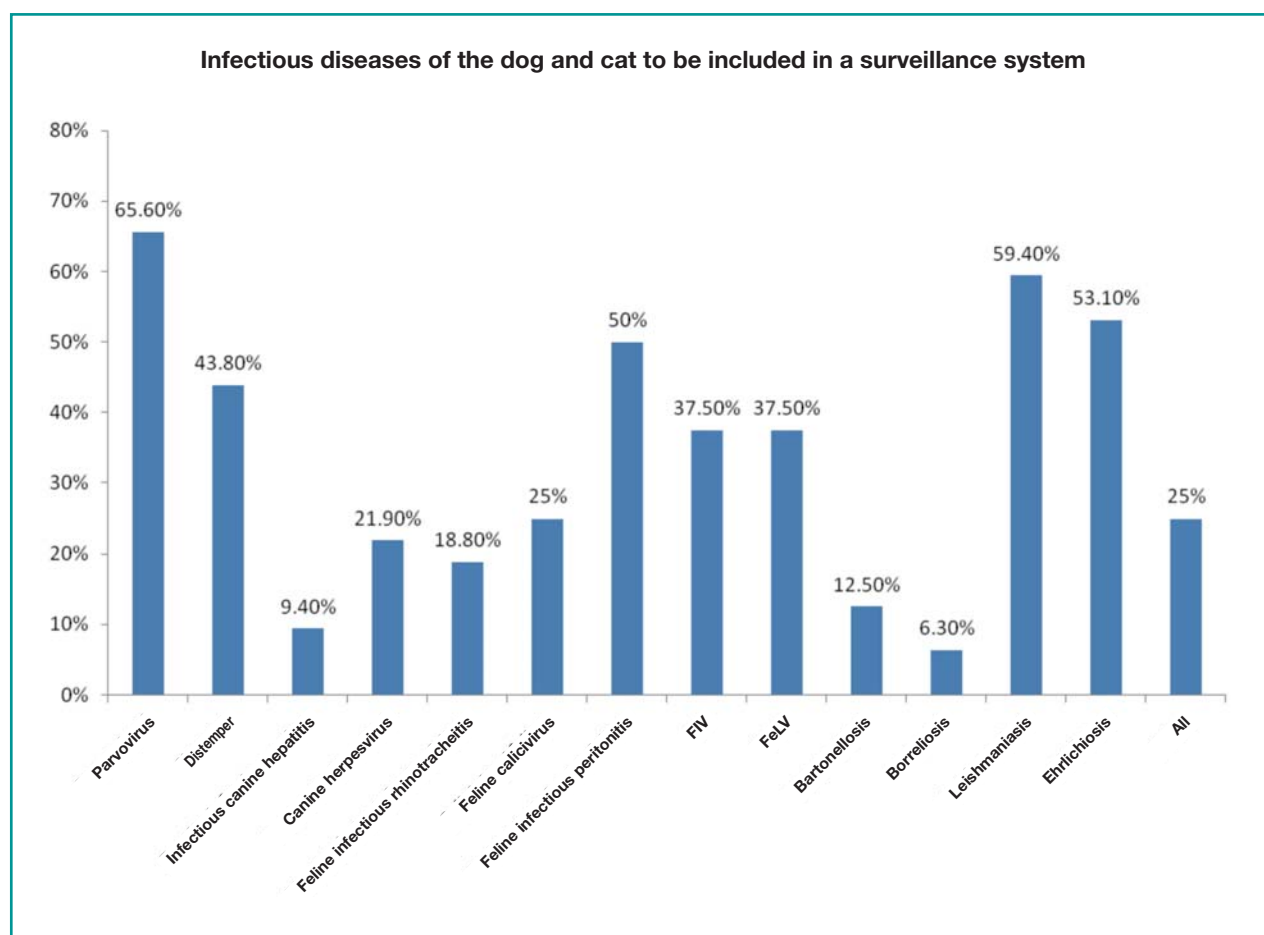


Figure 5 - Diagnostic tests used for parvovirus infections in the dog and cat.

believed that clients would also have an interest in setting up such a system, while 44% responded sometimes and 9% said no. The percentage of positive responses dropped to 22% when asked whether clients would also be willing to cover the cost of the diagnostic tests necessary for the development of such surveillance system; 31% responded frequently; 37.5% sometimes, 3% no and 3% didn't know. The diseases that Vets asked to include in a surveillance system are shown in Figure 6. Parvovirus infections received the highest percentage of requests (65.6%). Leptospirosis, feline chlamydiosis and feline haemoplasmosis were indicated in the category "other".

### Final section and open comments (Q. 41-42)

The questionnaire was considered useful (71%), adequate in length (60%) and clear (47%), while 6% found it long and 3% found it not useful. In the space dedicated to observations and open remarks some respondents complained that clients did not comply with vaccination intervals; others requested an epidemiological study on CPV-2 variants circulating in their area and others re-



**Figure 6** - Infectious diseases of the dog and cat to be included in a surveillance system.

quested the creation of a national surveillance programme for Leishmaniasis.

## DISCUSSION

Aim of the present work was to develop and validate a questionnaire addressed to veterinarians to ascertain their awareness, approach and behaviour with respect to parvovirus infections in the dog and cat. The validation phase required the administration of the questionnaire to a sample of 20-50 subjects, representative of the study population, but at this stage not necessarily chosen by random criteria.<sup>9</sup>

The face-to-face administration of the questionnaire allowed for a relatively high response rate.<sup>7</sup> However, a limitation of the study - for the sake of generalization - lies in the sampling methodology used. In the future, therefore, in order to extend the study, it will be desirable to recruit a larger number of sample units through randomization, starting for example from the list of members of the Board of Veterinarians of different cities. Despite the reduced size of the sample a comma some interesting data emerged from the analysis.

The proposed questionnaire proved useful to understand

the perception of the risk of parvovirus transmission among responding veterinarians as well as to allow analysis of the behaviour adopted accordingly. Analysis of the answers allowed the identification of some critical points. In fact, although the risk of contracting parvovirus is strongly influenced by the origin and vaccination status of the animals, by the environment in which they are bred and by their lifestyle, the origin of the animals was investigated by only 31% of the responding veterinarians and the environment in which they are kept and their lifestyle by only 14%. The absence of such information probably prevents the identification of high-risk animals and the implementation of appropriate prevention strategies.

Another important critical issue emerged with regard to the use of vaccines: only 56% of the respondents comply with the vaccination protocols recommended by international associations and in puppies, less than 18% perform serological titre tests for colostral antibodies to parvovirus prior to vaccination. Yet, these are two fundamental aspects of infection control. In fact, in kitten and puppies the most important factors that can jeopardize the success of vaccination protocols against par-

vovirus are the long persistence and interfering role of colostral antibodies.<sup>10,14</sup> It is well known that in 6-8 week old puppies, during the decline phase of MDA, an immunological gap is created whereby the animals become very receptive to infection but are still refractory to vaccination. In puppies of 8-12 weeks of age MDAs typically drop to levels not interfering with active immunization, but in some subjects they can persist for up to 16-20 weeks. For this reason, it is important to comply with international vaccination protocols that recommend starting the vaccination plan before the puppy reaches 8 weeks of age and repeating the vaccination at regular intervals until the puppy is 16-20 weeks old.<sup>10</sup> In this context also laboratory tests can play a significant role: the prevaccination serological examination for the determination of the MDA titre directed against parvovirus is to date the most effective tool to understand whether a puppy has passed the immunological gap phase and is ready to develop an active immune response with vaccination. Paradoxically, even subjects from the same litter may have a significantly different immune status between them. In confirmation of this, recent studies have shown an increased risk of vaccination failure in dogs vaccinated before the age of 16 weeks<sup>11</sup> and that unvaccinated or badly vaccinated animals are a cause of outbreaks.<sup>12</sup> The current questionnaire did not ask whether veterinarians had recorded during their activity any cases of parvovirus in vaccinated animals. In the future it would be interesting to assess whether animals responded effectively to the vaccination - perhaps using the rapid tests available today - as animals undergoing incomplete or incorrect protocols, which make the vaccination ineffective, are also often considered as vaccinated.

A better Vet-client relationship could also probably help veterinarians to adopt the most effective interventions for the containment and prevention of parvovirus infections. The client must receive the right information on the risk factors that facilitate the onset and transmission of the infection and on the environmental hygiene measures necessary to sanitize contaminated facilities. It is also important for Vets to adequately involve owners in the formulation of a personalized vaccination plan, which should take into account not only the physiological and health status of the animal but also the risk of exposure to potential environmental sources of infection.

Another critical issue that emerged from the analysis of the questionnaire concerns the use of a register of deaths. A very low percentage (12.5%) of veterinarians keep a register of deaths within their own facilities; the register could be an important database, useful, among other things, to understand the epidemiology of parvovirus within their territory; a large amount of possible information goes in fact lost due to the lack of recording.

### Veterinarians consider the creation of a surveillance system for infectious diseases of small animals useful.

The answers given in the subsequent sections of the questionnaire have instead highlighted a great attention to the prevention of nosocomial infections. In fact, 62.5% of the respondents have an isolation ward in their facility and demonstrated a very good approach with regard to environmental disinfection. More than half of the respondents (59%) stated that they have at least once suspected that one of their animals was infected with parvovirus within their own veterinary facility; this confirms previous work on suspected nosocomial parvovirus infections in veterinary facilities.<sup>13</sup>

Limitations were instead found with regard to the diagnostic approach used, as only 47% of responding veterinarians reported the systematic use of specific laboratory tests and/or in-house clinical kits to confirm the clinical suspicion of parvovirus in the dog. In the cat, this percentage dropped to 37.5%, probably because in this species the much more subtle clinical course of the infection and diarrhoea - which is not a constant symptom - signify that parvovirus infection is less often suspected. It should also be considered that a selection bias may be present in this work, with perhaps even an overestimation of the percentages observed, as respondents, being users of DiMedVet and IZS services, may have been more propense than others to use the laboratory to make a diagnosis. The certainty of the aetiological diagnosis is an essential prerequisite for the prevention and control of parvovirus in small animals and the absence of confirmation of the clinical diagnosis is always a serious shortcoming: the simple evaluation of clinical signs may in fact not allow the recognition of paucisymptomatic infections or may, on the contrary, lead to considering parvovirus responsible for different pathologies, which may instead be supported by other aetiological agents such as coccidia, other viruses and bacteria.<sup>14</sup> With regard to the type of tests used, only 40.6% of diagnostic confirmations of parvovirus infection in dogs and cats are made using biomolecular methods. Alternatively, respondents stated to use other types of tests which, however, being less sensitive and/or specific than biomolecular tests, can give false negative or false positive results.<sup>15-18</sup> For example, rapid tests can have a false-negative rate of up to 50% due to the formation of antibodies from the animal that can mask viral antigens.<sup>15-18</sup> The cost of the tests, considered too high by 50% of respondents, is certainly a real limit for the confirmation of the diagnosis. Some critical points were also highlighted with regard to the differential diagnosis: in fact, in the cat, about 70% of veterinarians suspect parvovirus in-

fection even in the absence of diarrhoea; 50% in the dog. This indicates the possibility that many subclinical or atypical infections may go unnoticed, with serious consequences also in terms of epidemiology, as unrecognised infected animals still contribute to the spread of parvovirus in the environment. The percentage of veterinarians who consider the possibility of a hyperacute form of panleukopenia in the cat in cases of suspected poisoning (28.1%) or sudden death (50%) is also reduced. A recent study, using biomolecular diagnosis, has indeed shown the presence of parvovirus in dead cats with suspected poisoning or sudden death.<sup>13</sup>

The analysis shows that in general the cat is always less investigated than the dog, probably because of the more subtle clinical manifestations. In addition, on average, cats are less vaccinated than dogs<sup>19</sup> and this makes the feline population at greater risk of infection. Recently, it has also been suggested that apparently healthy cats may shed CPV-2 variants and be a source of infection also for the dog.<sup>20</sup>

In view of the problems that emerged in this study with regard to the prevention and diagnosis of parvovirus infection in the dog and cat, it is possible to hypothesize that the creation of an epidemiological surveillance system for infection outbreaks and for the characterization of parvovirus strains circulating in the canine and feline population may represent a useful tool for the surveillance of such infections in the territory and for the evaluation of their impact on the health of small animals, which would otherwise not be objectively assessable.

Some 91% of respondents considered useful the creation of a notification system for infectious diseases of dogs and cats and 65.6% specifically requested it for the control of parvovirus infections. In addition, 59% said they would be willing to participate actively in its possible establishment.

Parvovirus infections are an endemic disease in Italy and the creation of a surveillance plan would make it possible to create and continuously update a risk map on the spread of CPV-2 and FPV in the territory, thus con-

tributing to the implementation of a more effective prophylaxis. Such a plan could also be a useful project for the control of other infectious diseases of small animals.

**A surveillance system would allow for a better control of infection trends, allowing the planning of targeted interventions.**

## CONCLUSIONS

The proposed questionnaire proved to be a valuable tool in order to survey the opinions of veterinarians on the severity of parvovirus infections in the dog and cat and their ability to manage such infections. The common perception is that despite the widespread use of vaccines, parvovirus infections in domestic carnivores still represent a very serious unsolved problem. The analysis of the answers to the questionnaire revealed the existence of several critical issues concerning the identification of risk factors, the application of vaccination protocols and the confirmation of the diagnosis. In fact, a too limited percentage of respondents comply with the vaccination protocols recommended by international veterinary associations and perform in puppies serological titre tests for colostral antibodies to parvovirus prior to vaccination. An equally limited number of veterinarians choose to use the most sensitive and specific laboratory tests to confirm the clinical suspicion of infection. Finally, a large majority of respondents support the idea of creating a notification system for infectious diseases of the dog and cat, which would be particularly useful for the control of parvovirus infections.

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## KEY POINTS

- In Italy parvovirus is estimated to be a frequent cause of death.
- Only 56% of responding veterinarians comply with the vaccination protocols recommended by international guidelines.
- The cost of tests is an obstacle to confirming the diagnosis of parvovirus.
- A change of certain habits and behaviours of veterinarians in their approach to parvovirus could help to contain the spread of the infection.
- The creation of a surveillance system for infectious diseases of the dog and cat could be a useful tool to facilitate the control of parvovirus.

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# QUESTIONNAIRE

## TYPE OF VETERINARY FACILITY:

**1) The veterinary facility in which you work is:**

- ☐ Private
- ☐ Public
- ☐ Other

**2) In which type of veterinary facility do you work in? (indicate only one answer; if you work in more than one facility, tick the facility in which you predominantly work or, if you are answering the questionnaire on behalf of the facility, tick the type of facility you are answering for):**

- ☐ Outpatient clinical practice (no overnight stay; patients are discharged at the end of the workday)
- ☐ Veterinary clinic (day service; hospitalization)
- ☐ Veterinary Hospital (day service; hospitalization; 24-hour emergency service; at least one veterinarian present in the facility on a continuous basis)
- ☐ Kennel/Cattery
- ☐ Other (specify: .....)

**3) The facility is located in:**

- ☐ Northern Italy
- ☐ Central Italy
- ☐ Southern Italy

**4) What is your role within the veterinary facility? (more than one answer can be ticked)**

- ☐ Owner of the facility
- ☐ Medical Director
- ☐ Veterinarian employed by the facility
- ☐ Intern or other

**5) How old are you?**

- ☐ <35
- ☐ 36-45
- ☐ 46-55
- ☐ >56

## CLINICAL HISTORY AND DATA COLLECTION:

**6) Do you consider exhaustive the information given by DOG and CAT owners about the origin of their kitten or puppy (shop, kennel, shelter, Italian, EU or non-EU breeder, etc.)?**

- ☐ Always
- ☐ Sometimes
- ☐ Only for the dog
- ☐ Only for the cat
- ☐ Never
- ☐ It is not something I usually discuss with the owner
- ☐ I don't know

**7) Do you consider exhaustive the information given by owners regarding the environment and lifestyle of their animal and their risk of acquiring Parvovirus infection (possibility of contact with other animals, risk of exposure to parvovirus, frequency of going outdoors, etc.)?**

- ☐ Always
- ☐ Sometimes
- ☐ Only for the dog
- ☐ Only for the cat
- ☐ Never
- ☐ It is not something I usually discuss with the owner
- ☐ I don't know

**8) Is it important to know the vaccination status of the patient?**

- ☐ Yes
- ☐ No
- ☐ Sometimes

**9) Do you usually explain vaccination risks and benefits to the owner?**

- ☐ Yes
- ☐ No
- ☐ Sometimes

**10) Are you aware of the existence of international vaccination protocols for the dog and cat drawn up by various Veterinary Associations (e.g., WSAVA, World Small Animal Veterinary Association; AAEP, American Association of Feline Practitioners; ABCD, European Advisory Board on Cat Diseases; AAHA, American Animal Hospital Association)?**

- ☐ Yes  
☐ No

**11) If yes, do you comply with the vaccination protocols recommended by these associations?**

- ☐ Yes  
☐ Yes, but only in the DOG  
☐ Yes, but only in the CAT  
☐ Yes, but only in some cases  
☐ No

**12) Before starting the vaccination prophylaxis in a puppy/kitten, do you find it useful to perform serological tests that reveal the titre of colostral antibodies to parvovirus?**

- ☐ Yes, because colostral antibodies can interfere with successful vaccination  
☐ Yes, only in the DOG  
☐ Yes, only in the CAT  
☐ Yes, only in some cases  
☐ No, because in the animals that I vaccinate for parvovirus I do not record incidents attributable to vaccine use  
☐ No, because I use a vaccination protocol designed to overcome the interfering role of colostral antibodies  
☐ I don't know

**13) If you consider the colostral antibody titre a useful piece of information to be acquired at the time of vaccination, under what circumstances do you use serological tests?**

- ☐ Always  
☐ Only in animals at high risk of virus exposure  
☐ Only if the owner is willing to pay the expenses  
☐ Rarely  
☐ Never because the methodology is too laborious

**14) Do you know the epidemiology of parvovirus in the territory in which you work (frequency of infections in the dog and cat, appearance of new outbreaks, type of viral variants present in the dog and cat)?**

- ☐ Yes  
☐ No

**15) In your practice, are the causes of DOG and CAT death usually recorded, regardless of the manner?**

- ☐ Yes  
☐ No  
☐ Yes, but only for DOGS  
☐ Yes, but only for CATS  
☐ Yes, but only if there is a definite diagnosis  
☐ I don't know

#### PREVENTION:

**16)? Does your facility have a specific inpatient ward for infectious diseases?**

- ☐ Yes  
☐ No  
☐ I don't know

**17) If yes, has an isolation space (i.e. a room, a cage, etc.) been dedicated exclusively for patients infected with parvovirus?**

- ☐ Yes  
☐ No  
☐ I don't know

**18) What do you use to disinfect the environment in which an animal with parvovirus was visited and hospitalized? (more than one answer can be ticked)**

- ☐ Bleach, diluted or pure, allowing contact for at least 10 minutes with the surface to be disinfected  
☐ Bleach, diluted or pure, only to clean surfaces  
☐ Steam  
☐ Alcohol  
☐ Chlorhexidine  
☐ Household detergent for cleaning surfaces  
☐ Other (specify: .....)  
☐ I don't know

**19) Have you ever had the suspicion or certainty that an animal was infected with parvovirus while being in your clinic?**

- ☐ Yes  
☐ No

# DIAGNOSTIC APPROACH USED IN CASE OF SUSPECTED PARVOVIRUS INFECTION:

20) Could you indicate the approximate number of cases of parvovirus in the DOG diagnosed per year in the facility in which you work?

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21) Could you indicate the approximate number of cases of parvovirus in the CAT diagnosed per year in the facility in which you work?

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.....

22) What is the death rate that you attribute to CANINE parvovirus in your facility (no. of deaths due to parvovirus/no. of parvovirus patients)?

- ☐ <25%
- ☐ Between 26 and 50%
- ☐ Between 51 and 75%
- ☐ >75%

23) What is the death rate that you attribute to FELINE parvovirus in your facility?

- ☐ <25%
- ☐ Between 26 and 50%
- ☐ Between 51 and 75%
- ☐ >75%

24) If more than one veterinarian work in the same unit or clinic (answer this question only in this case), do you have a shared diagnostic protocol for cases of suspected parvovirus?

- ☐ Yes
- ☐ No
- ☐ I don't know

25) In case of clinical suspicion of parvovirus infection in a DOG, do you confirm the diagnosis with specific tests in order to identify the virus (PCR, rapid tests, etc.)?

- ☐ Yes
- ☐ No
- ☐ Sometimes

26) In case of clinical suspicion of parvovirus infection in a CAT, do you confirm the diagnosis with specific tests in order to identify the virus (PCR, rapid tests, etc.)?

- ☐ Yes
- ☐ No
- ☐ Sometimes

27) Which test do you typically use to confirm the diagnosis of parvovirus in the DOG? (more than one answer can be ticked)

- ☐ Only clinical signs
- ☐ Haematobiochemical profile
- ☐ Rapid in-house test kits
- ☐ Molecular biology tests carried out in specialized laboratories

28) Which test do you typically use to confirm the diagnosis of parvovirus in the CAT? (more than one answer can be ticked)

- ☐ Only clinical signs
- ☐ Haematobiochemical profile
- ☐ Rapid in-house test kits
- ☐ Molecular biology tests carried out in specialized laboratories

29) Is the NON willingness of the owner to pay for the cost of the confirmation test a limit in the diagnostic confirmation of parvovirus?

- ☐ Yes
- ☐ No
- ☐ Sometimes

30) Did you ever personally pay for the costs of the confirmatory test in order to eventually confirm the diagnosis of parvovirus?

- ☐ Yes
- ☐ No
- ☐ I don't remember

31) Do you ever include parvovirus among the differential diagnoses in DOGS that do NOT have diarrhoea?

- ☐ Yes
- ☐ No
- ☐ I don't know

32) Do you ever include parvovirus among the differential diagnoses in CATS that do NOT have diarrhoea?

- ☐ Yes
- ☐ No
- ☐ I don't know



**33) Have you ever observed subclinical or asymptomatic forms of parvovirus in the DOG and CAT?**

- ☐ Yes  
☐ Yes, only in the DOG  
☐ Yes, only in the CAT  
☐ No

**34) In the case of hyperacute death of a CAT, do you include parvovirus among the differential diagnoses?**

- ☐ Yes  
☐ No  
☐ Sometimes

**35) In the case of suspected poisoning of a CAT, do you include parvovirus among the differential diagnoses?**

- ☐ Yes  
☐ No  
☐ Sometimes

#### **CREATION OF A NOTIFICATION INFORMATION SYSTEM FOR INFECTIOUS DISEASES OF THE DOG AND CAT:**

**36) Would you consider it useful to create an information system to notify outbreaks of infectious diseases of the DOG and CAT and to verify their presence and distribution in your territory?**

- ☐ Yes  
☐ No  
☐ I don't know

**37) If established, would you be willing to contribute to the surveillance system by reporting cases of infectious diseases occurring in the DOG and CAT?**

- ☐ Yes  
☐ No  
☐ Yes, but only if it doesn't take up too much time  
☐ I don't know

**38) Do you consider owners of small animals to be generally receptive to the problem of the spread of infectious diseases in the dog and cat?**

- ☐ Yes  
☐ No  
☐ Sometimes  
☐ I don't know

**39) Do you believe that owners of small animals are on average willing to bear the cost of diagnostic tests for infectious diseases of the dog and cat?**

- ☐ Yes  
☐ No  
☐ Rarely  
☐ Often  
☐ I don't know

**40) For which diseases would you consider it useful to create a notification system? (more than one answer can be ticked)**

- ☐ Parvovirus  
☐ Distemper  
☐ Infectious Canine Hepatitis  
☐ Canine Herpesvirus  
☐ Feline Herpesvirus  
☐ Feline Calicivirus  
☐ Feline Infectious Peritonitis  
☐ FIV  
☐ FeLV  
☐ Bartonellosis  
☐ Borreliosis  
☐ Leishmaniasis  
☐ Ehrlichiosis  
☐ Other (specify: .....)  
☐ All the above

**41) How do you judge the questionnaire you have just completed? (more than one answer can be ticked)**

- ☐ Long  
☐ Short  
☐ Adequate in length  
☐ Clear  
☐ Ambiguous  
☐ Useful  
☐ Not useful  
☐ I don't know

**42) Comments and open remarks:**

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