Graña A, Carrera C, Botana LM. Current perspective of vaccination in Spain for dogs and cats from a pharmaceutical approach. Pharmacy Practice 2023 Oct-Dec;21(4):2865.

https://doi.org/10.18549/PharmPract.2023.4.2865

**Original Research**

# Current perspective of vaccination in Spain for dogs and cats from a pharmaceutical approach

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Received (first version): 18-Apr-2023 Accepted: 05-Jun-2023 Published online: 26-Oct-2023

**Abstract**

**Background:** The development of clinical pharmacy practice for humans and animals in the recent years has resulted in new goals and challenges for pharmacists that work to improve patient care, preventing medication related problems and optimizing resources. Currently, in Spain, there are so many dogs' and cats' vaccines from different manufacturers, with different microorganisms' combination which are not readily identifiable. This fact makes us wonder if they are all necessary and/or convenient, and if they meet the criteria of the international guidelines. **Objective:** It aimed to examine the current situation of vaccination in dogs and cats in Spain, as well as if available vaccines are suitable, or if the technical data sheets match with the recommendations of consensus guides. **Methods:** All available vaccines in Spain were counted, evaluated and classified by using the search engine CIMAvet, into monovalent or combined and suitable or unsuitable according to their composition and vaccination schedule with guidelines WSAVA and COLAVAC. **Results:** As a result, we found 15 vaccines for dogs and 7 for cats, when attending to its composition. However, it gives rise to 46 vaccines for dogs and 14 for cats, if we regarded to the different manufacturers. The 69.6% of dogs' and 57.1% of cats' vaccines were considered unsuitable. Resulting as optimal combinations of microorganisms: Bordetella+Parainfluenza, Distemper+Adenovirus+Parvovirus, Leptospira alone and Rabies alone for dogs and Calicivirus+Herpes virus+Panleukopenia, Leukemia alone and Rabies alone for cats. Besides, it was observed that vaccines data sheet don´t meet with international schedule in percentages of 69.6% and 64.3% respectively. **Conclusion:** Only 28.6% of dogs' and 42.9% of cats' vaccines in Spain, are considered suitable, and 30.4% of dogs' and 35.7% of cats' vaccines data sheets fully agree with guidelines. Thus, we highly suggest, data sheets updating a recommended vaccination schedule and the unification in vaccines nomenclature, totally necessary, from our point of view, to help veterinarians in the clinical decision-making process to vaccinate properly with the lowest risks and minimizing costs, promoting therapeutic adherence and providing a beneficial impact on animals and society. .

**Keywords:** vaccines; dogs; cats; pharmacist; Spain

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## INTRODUCTION

Vaccination remains an essential and cost-effective method of infectious disease control, whose goal is to induce a protective immune response against a target pathogen without the risk of suffering a disease.[1-3] Active immunization, achieved through proper vaccination, plays a critical role in the control of zoonotic and infectious diseases in animals and humans.[1,3,4] The role of the veterinary pharmacists within One Health has been highlighted during (COVID-19) pandemic, providing an important service during the zoonotic event.[5]

Worldwide, preventive vaccination in veterinary medicine needs clarifying protocols and recommendations due to multitude of vaccine options available to veterinarians with diverse nomenclature and composition that makes their management even more difficult. Ideally, these recommendations should be based on pathogen prevalence in specific areas where the guidelines are applied, but in many cases this information is not available, so general recommendations from broader regions are extrapolated. This is the case of the general guideline for the vaccination of dogs and cats, which has a global application published by World Small Animal Veterinary Association (WSAVA).[4] In 2020, the Latin American Committee for Vaccination (COLAVAC) published the first immunization recommendations for infectious diseases in cats and dogs, specific to Spain and Portugal, considering epidemiological characteristics and idiosyncrasies of clinical practice in these

https://doi.org/10.18549/PharmPract.2023.4.2865

countries, justifying the real necessary vaccines in Spain.[6] These necessary vaccines are called Core and include vaccines that protects against potentially dangerous diseases for public health, required by law, recommended for all pets and that protects against highly infectious and/or serious diseases. On the other hand, Non-Core vaccines protect against some specifical geographical localization microorganism, or are lifestyle-dependent.[4,6–8] Despite these guidelines stablish the main recommended vaccines and their administration, vaccination is a clinical act, so the veterinarian is who must decide which vaccine has to be administered in each case. Nevertheless, responding to new challenges, hospital pharmacists are in a unique position because they are responsible of the selection of medicines to guarantee the efficacy, safety, and quality, with the lowest cost of medicines at hospitals.[9] Therefore, because of this premise, the great variety of vaccines existing in Spain and the large number of questions about routine vaccination made in our veterinary pharmacy service, this study was performed. It aimed to examine the current situation of vaccination in dogs and cats in Spain, as well as if available vaccines are suitable, or if the technical data sheets match with the recommendations of consensus guides.

## METHODS

### Search strategy, selection criteria and nomenclature

Search strategy to collect available vaccines in Spain was carried out between February 2, 2023, and April 9, 2023, and it was developed on the Spanish Agency of Medicines and Health Products (AEMPS).[10] Through the online portal CIMAvet, a database that provides constantly updated online information on available authorization for veterinary medicines. In this portal, using the advanced search engine, we limited the search by available/marketed vaccines and by Anatomical Therapeutic Chemical (ATC-Vet). It is a classification system for veterinary medicines at different levels, according to their therapeutic, chemical, and pharmacological properties and practical applications. This classification system can be used specifically as a basic tool for drugs utilization research.

ATC-Vet codes searched were QI07 IMMUNOLOGICALS FOR CANIDAE (Dogs' vaccines) and QI06 IMMUNOLOGICAL FOR FELIDAE (Cats' vaccines). These codes were subdivided by therapeutic subgroups to classify them. In addition, during the search, technical data sheets of each authorized vaccine were downloaded through a direct access to this portal to compare them with guidelines.

All vaccines that were not available/ marketed or authorized in Spain were excluded as well as those that were not included in the WSAVA and COLAVAC guidelines (Leishmania, Babesia and Herpes virus for dogs).[4,6]

The included vaccines were classified into Core and Non-Core, as in the guidelines, and due to the diverse nomenclature observed in vaccines with the same composition, they were analyzed by their scientific name and referring them as follows:

Core for dogs: Canine Distemper Virus (Distemper), Canine Adenovirus (Adenovirus), Parvovirus type 2 (Parvovirus), Leptospira and Rabies and for cats: Feline Calicivirus (Calicivirus), Feline Leukemia (Leukemia), Feline Panleukopenia (Panleukopenia), Feline Herpes Virus (Herpes virus) and Rabies. On the other hand, Non-Core for dogs were Bordetella and Parainfluenza virus (Parainfluenza) and for cats Chlamydia and Feline Infectious Peritonitis (Infectious Peritonitis).

Results were expressed numerically and as percentages.

### Suitable and unsuitable recommendations

Suitable vaccines were defined as those that included the combination of pathogens, with common vaccination guidelines to carry out the correct vaccination of dogs and cats, avoiding risks of overdose. Unsuitable vaccines were defined as those that combined pathogens with different administration schedules, which could increase the risk of over-vaccination, and those that were unnecessary because there are other more appropriate combinations available.

### Comparison criteria between guidelines and datasheet

The chosen guides for comparison were WSAVA and COLAVAC because both are complementary in structure and administration scheme.[4,6]

Compared items were number of doses recommended in the technical data sheet (ND), frequency of administration (FA) and frequency of revaccination (RV) that were extracted from the dose section of each technical data sheets. The degree of correspondence between guidelines and technical sheets was established by means of a colored traffic light. Red: Non-conformance in three items. Orange: Non-concordance in some item. Green: Concordance in three items.

## RESULTS

### Compilation and classification of all vaccines authorized and available in Spain for dogs and cats

For dogs a total of 46 vaccines authorized and available in Spain from different manufacturers were quantified and reported in (Table 1). According to their composition, these vaccines were classified into 15 types and are mostly combined (73.3%) and Core (53.3%).

For cats a total of 14 vaccines authorized and available in Spain from different manufacturers were quantified in (Table 2). According to their composition these were classified into 7 types. These vaccines are mostly combined (57.1%) and Core (57.1%).

### Suitable and unsuitable recommendations

In dogs, guides recommend a revaccination interval of 1 year for: Bordetella, Parainfluenza, Leptospira and Rabies and 3 years for: Distemper, Adenovirus and Parvovirus because antibodies last for about 1 and 3 years or more respectively. So, from the 15 vaccines classified by their composition, we have considered suitable: Bordetella+Parainfluenza, Distemper+Adenovirus+Parvovirus, Leptospira alone and Rabies alone. The remaining combined vaccines for

https://doi.org/10.18549/PharmPract.2023.4.2865

Table 1. Count and classification of vaccines from different manufacturers available in Spain for dogs

| **Composition of vaccines** | **Monovalent / Combined** | **Core / NonCore** | **Therapeutic subgroup** | **Tradenames** |
|---|---|---|---|---|
| Bordetella | Monovalent | Non Core | Live Bacteria QI07AE | VERSICAN PLUS BB |
| | | | Inactivated bacteria QI07AB | NOBIVAC RESPIRA Bb |
| Bordetella+Parainfluenza | Combined | Non Core | Live bacteria and virus QI07AF | NOBIVAC KC and VERSICAN PLUS BBPI |
| | | | Live and inactivated virus and bacteria QI07AL | EURICAN PNEUMO |
| Distemper+Parvovirus | Combined | Core | Live virus QI07AD | NOBIVAC DP PLUS, MAXIVAC PRIMA DP and VERSICAN PLUS DP |
| Distemper+Adenovirus+ Leptospira | Combined | Core | Inactivated virus and inactivated bacteria QI07AJ | MAXIVAC TETRA and CANIGEN MHA2L |
| Distemper+ Adenovirus+ Parvovirus | Combined | Core | Live virus QI07AD | EURICAN DAP, NOBIVAC DHP and VERSICAN PLUS DHP |
| Distemper+ Adenovirus+ Parvovirus+Leptospira | Combined | Core | Inactivated virus and inactivated bacteria QI07AJ | MAXIVAC PENTA, EURICAN DAP-LMULTI and CANIGEN MHA2PL |
| Distemper+Adenovirus+ Parvovirus+ Parainfluenza | Combined | Combination | Live virus QI07AD | CANIGEN DHPPI, NOBIVAC DHPPI and VERSICAN PLUS DHPPi |
| Distemper+Adenovirus+ Parvovirus+ Parainfluenza+ Leptospira | Combined | Combination | Inactivated virus and inactivated bacteria QI07AL | VERSICAN PLUS DHPPI/L4, VANGUARD7, VANGUARD DA2Pi+L, MAXIVAC HEPTA and EURICAN DAPPI-LMULTI |
| | | | Live virus and Inactivated bacteria QI07AI | CANIGEN DHPPi/L |
| Distemper+Adenovirus+ Parvoritus+Rabies+ Leptospira | Combined | Core | Live virus and Inactivated bacteria QI07AI | EURICAN DAP-LR |
| Distemper+ Adenovirus+ Parvovirus+ Parainfluenza+ Rabies+ Leptospira | Combined | Combination | Live virus and Inactivated bacteria QI07AI | EURICAN DAPPi-LR and VERSICAN PLUS DHPPi/L4R |
| Leptospira | Monovalent | Core | Inactivated bacteria QI07AB | EURICAN L MULTI, NOBIVAC LEPTO, CANIGEN L4 and NOBIVAC L4 |
| Parvovirus | Monovalent | Core | Live virus QI07AD | CANIGEN CACHORROS 2b, EURICAN PRIMO, MAXIVAC PARVO, NOBIVAC PARVO C, VANGUARD CPV and PARVIGEN |
| Parainfluenza+ Leptospira | Combined | Combination | Inactivated virus and inactivated bacteria QI07AL | VERSICAN PLUS PiL4 |
| Parainfluenza+ Leptospira+ Rabies | Combined | Combination | Inactivated virus and inactivated bacteria QI07AJ | VERSICAN PLUS PI/L4R |
| Rabies | Monovalent | Core | Inactivated virus QI07AA | ETADEX, EURICAN R, NOBIVAC RABIA, RABIGEN L, RABISYVA VP-13 and VERSIGUARD RABIA |
| Σ 15 | Combined 73.3% | Core 53.3% | | Σ 46 |

Table 2. Count and classification of vaccines from different manufacturers available in Spain for cats

| **Composition of vaccines** | **Monovalent / Combined** | **Core / NonCore** | **Therapeutic subgroup** | **Tradenames** |
|---|---|---|---|---|
| Calicivirus+Herpes virus+Panleukopenia | Combined | Core | Inactivated virus QI06AA | VERSIFEL CVR |
| | | | Live virus QI06AD | NOBIVAC TRICAT and FELIGEN CRP |
| | | | Live and inactivated virus in association QI06AH | PUREVAX RCP |
| Calicivirus+Herpes virus+Panleukopenia+ Chlamydia | Combined | Combination | Other vaccines QI06AX | PUREVAX RCPCH |
| Calicivirus+Herpes virus+Panleukopenia+ Leukemia | Combined | Core | Live and inactivated virus in association QI06AH | LEUCOFELIGEN FELV/RCP and PUREVAX RCP FELV |

https://doi.org/10.18549/PharmPract.2023.4.2865

| | | | | |
|---|---|---|---|---|
| Calicivirus+Herpes virus+Panleukopenia+ Chlamydia+Leukemia | Combined | Combination | Other vaccines QI06AX | PUREVAX RCPCH FeLV |
| Infectious Peritonitis | Monovalent | Non Core | Live virus QI06AD | PRIMUCELL FIP |
| Leukemia | Monovalent | Core | Inactivated virus QI06AA | VERSIFEL FeLV, LEUCOGEN and NOBIVAC LEUFEL |
| | | | Live virus QI06AD | PUREVAX FeLV |
| Rabies | Monovalent | Core | Other vaccines QI06AX | PUREVAX RABIES |
| Σ 7 | Combined 57.1% | Core 57.1% | | Σ 14 |

dogs were considered unsuitable because of the different vaccination schedule of their pathogens, or in the case of Distemper+Parvovirus because there are more appropriate options to choose the same as Parvovirus or Bordetella alone. This means that suitable vaccines for dogs represent 26.7% and unsuitable 73.3%

In cats, guides recommend a revaccination interval of 1 year for: Chlamydia, Infectious Peritonitis and Rabies and 3 years for: Calicivirus, Herpes virus, Leukemia, and Panleukopenia while antibodies last. Thus, from the 7 vaccines classified by their composition, we have considered suitable: Calicivirus+Herpes virus+Panleukopenia, Leukemia alone and Rabies alone. Nevertheless, the remaining combined vaccines have been considered unsuitable because of the different revaccination interval of their pathogens; Leukemia in combination because it must be tested in each case previous administration and Infectious Peritonitis because guides do not recommend it according to its limited studies. This means that suitable vaccines for cats represent 42.9% and unsuitable 57.1%.

**Comparison of vaccine datasheets with WSAVA and COLAVAC vaccination guidelines**

To determine whether there were similarities corresponding to number of doses, frequency of administration and revaccination, all vaccines authorized and available in Spain for dogs and cats from different manufacturers; guides and datasheet were analyzed.

The results show that the percentages of non-conformance, represented by red color, were 13.1% for dogs and 7.2% for cats. The orange color, referred to the discrepancy in some item (revaccination, number of doses and frequency of administration) reveled a 56.5% for dogs and 57.1% for cats. In this case, the main disagreement is associated with revaccination item (76.9% for dogs and 87.5% for cats) *vs.* number of doses (3.9% for dogs and 0.0% for cats) and frequency of administration (12.9% for dogs and 12.5% for cats). Lastly the percentage of concordance or color green was 30.4% for dogs and 35.7% for cats. Consequently, the percentage represented by red and orange colors (69.6% for dogs and 64.3% for cats) constitutes more than one-half of the vaccines, whereas the percentage of concordance or color green makes up a smaller part of the vaccines. The outcomes are shown in (Table 3) for dogs and (Table 4) for cats.

Table 3. Results of comparison dogs' vaccine datasheets with WSAVA and COLAVAC vaccination guidelines expressed as a percentage

| Colored traffic light | Percent | Composition of vaccines | Vaccine number |
|---|---|---|---|
| Red | 13.1% | Distemper+Adenovirus+Parvovirus+ Parainfluenza+Leptospira | 1 |
| | | Distemper+Adenovirus+Parvovirus+ Parainfluenza+Rabies+Leptosipira | 2 |
| | | Distemper+Parvovirus | 1 |
| | | Parainfluenza+Leptospira+Rabies | 1 |
| | | Parvovirus | 1 |
| Orange | 56.5% | Bordetella | 1 |
| | | Bordetella+Parainfluenza | 2 |
| | | Distemper+Adenovirus+Leptospira | 2 |
| | | Distemper+Adenovirus+Parvovirus | 1 |
| | | Distemper+Adenovirus+Parvovirus+ Leptospira | 3 |
| | | Distemper+Adenovirus+Parvovirus+ Leptospira+Rabies | 1 |
| | | Distemper+Adenovirus+Parvovirus+ Parainfluenza | 1 |
| | | Distemper+Adenovirus+Parvovirus+ Parainfluenza+Leptospira | 5 (2*) |
| | | Distemper+Parvovirus | 1 |
| | | Parvovirus | 4 |
| | | Rabies | 5 |
| Green | 30.4% | Bordetella | 1 |
| | | Bordetella+Parainfluenza | 1 |
| | | Distemper+Adenovirus+Parvovirus | 2 |
| | | Distemper+Adenovirus+Parvovirus+ Parainfluenza | 2* |
| | | Distemper+Adenovirus+Parvovirus+ Parainfluenza+Leptospira | 1* |
| | | Distemper+Parvovirus | 1 |
| | | Leptospira | 4 |
| | | Parainfluenza+Leptospira | 1 |
| | | Rabies | 1 |
| | Σ 100% | | Σ 46 |

Red: Non-conformance in number of doses, frequency of administration and revaccination between guidelines and vaccine datasheets. Orange: Non-concordance in any items. Green: Concordance in number of doses, frequency of administration and revaccination between guidelines and vaccine datasheets. * Datasheets that describe differences in the duration of immunity between the pathogens contained.

https://doi.org/10.18549/PharmPract.2023.4.2865

Table 4. Results of comparison cats' vaccine datasheets with WSAVA and COLAVAC vaccination guidelines expressed as a percentage

| Colored traffic light | Percent | Composition of vaccines | Vaccine number |
|---|---|---|---|
| Red | 7.2% | Calicivirus+Herpes virus+Panleukopenia+Chlamydia+Leukemia | 1 |
| Orange | 57.1% | Calicivirus+Herpes virus+Panleukopenia | 3 |
| | | Calicivirus+Herpes virus+Panleukopenia+Chlamydia | 1* |
| | | Calicivirus+Herpes virus+Panleukopenia+Leukemia | 2* |
| | | Leukemia | 1 |
| | | Rabies | 1 |
| Green | 35.7% | Calicivirus+Herpes virus+Panleukopenia | 1 |
| | | Infectious Peritonitis | 1 |
| | | Leukemia | 3 |
| | Σ 100% | | Σ 14 |

Red: Non-conformance in number of doses, frequency of administration and revaccination between guidelines and vaccine datasheets. Orange: Non-concordance in any items. Green: Concordance in number of doses, frequency of administration and revaccination between guidelines and vaccine datasheets. * Datasheets that describe differences in the duration of immunity between the pathogens contained.

## DISCUSSION

The development of effective vaccines against different diseases is considered an important step towards diseases control.[1–4,6–8] A huge range of vaccines has been developed to protect dogs and cats, what is really important to avoid a fatal illness or to prevent zoonosis in human beings.[4,6–8] Veterinarians must be confident to use them properly and recognize them without any doubt. In our findings, we have observed that there are no standard abbreviations to distinguish one vaccine from another, so vaccine records, in vaccination card, can be challenging to interpret when abbreviations or acronyms are used in packages. The wide variety of vaccines in use today, might not be clear in their label and it could be confusing to select a specific brand. In our opinion, abbreviations or acronymous unification in vaccines packages can help the veterinarian to select the right vaccine and reduce hesitancy in vaccination and reduce the risk of confusion.

### Suitable and unsuitable recommendations

Currently, in Spain there are 15 types of dogs' vaccines according to their composition and 7 for cats including all core vaccines recommended internationally. Available vaccines in Spain have gone through an evaluation process whose risk/benefit ratio has been favorable. Nevertheless, it is well known that although vaccination is a safe medical procedure, the possibility of adverse events is a concern in companion animals.[4,6–8,11,12] As can be observed from the reports of pharmacovigilance published by AEMPS and EMA, vaccines constitute the largest notification in Spain and the second in Europe.[13,14] Besides, it has been observed that the vaccinovigilance system from Switzerland has shown that dogs (41.0%) and cats (25.0%) are the main species affected.[15]

The high presence of multivalent products containing more than just one pathogen (73.3% in dogs and 57.1% in cats) should be carefully evaluated because the expected duration of immunity (DOI) is different depending on the agent involved and so, an overdose or over vaccination could occur. However, it is important to note that the availability of combined vaccines can help to reduce the number of injections required with less pain and discomfort or provide on-time protection greatly simplifying the immunization.[16]

It is well known that the vaccines composed by Distemper+Adenovirus+Parvovirus are essential vaccines worldwide. Besides, Distemper and Adenovirus has been described in ferrets, lynxes, wolves or foxes, or even in adult dogs in Spain and Parvovirus variants have been reported in European countries.[17–22] Furthermore, these microorganisms share immunization schedule, every three years, providing protection in a unique administration.[4,6,8] So, we have classified the association like suitable. Despite Bordetella and Parainfluenza are not core vaccines, we also consider this combination suitable to dogs that are frequently exposed to other dogs in social or boarding school settings with revaccination every year. In this way, being both non-core vaccines, when the administration is considered necessary, Bordetella+ Parainfluenza combination with a single intranasal dose is the best option.[23,24] There are 3 vaccines composed by Bordetella+Parainfluenza in the market provided from different manufactures and with different ATC code like Live bacteria and virus (QI07AF) or Live and inactivated virus and bacteria (QI07AJ). Both are good options but, inactivated vaccines are usually preferred because they tend to be safer and more stable.[25–27] Moreover, microorganisms in attenuated vaccines may be killed by incorrect handling and they are not recommended in pregnant or immunosuppressed animals.[28,29]

We also deemed suitable, monovalent vaccines for Leptospira and Rabies. Leptospira has been observed in companion and wild animals and even in humans in Spain.[30–34] Its vaccination calendar (1-year its DOI) is not common to the rest of the microorganisms usually linked to Distemper+Adenovirus+Parvovirus, so Leptospira alone was selected as the best option.[31,32,34] In the case of Rabies, it has specific legal considerations in each territory.[4,6,8] Moreover although it is considered eradicated in Spain, its vaccination must continue to avoid possible out-breaks from other countries or wild animals.[35,36]

On the other hand, we consider the rest of combinations with Distemper+Adenovirus+Parvovirus unsuitable for dogs. The reason is that most of them could increase the risk of over-vaccination due to the different DOI.[4,6,8,37] It would be easy to make a mistake and routinely vaccinate every year instead of every three years, eliciting a risk of adverse effects giving these vaccines too frequently.[4,6,8,11,38]

In addition, we consider that the absence of Adenovirus in Distemper+Parvovirus vaccine or Parvovirus alone make them impractical and would elicit under-vaccination or an overvaccination because Adenovirus alone, and Distemper +Adenovirus, that are essentials for a right immunization are not marketed. Finally, like we have seen above, Bordetella+Parainfluenza is an important combination, so the presence of a vaccine with Bordetella as the only microorganism would not provide any benefit.

For cats, we consider the combination vaccines Calicivirus+Herpes virus+Panleukopenia suitable. They are all core, all microorganisms have been reported in Spain recently and share vaccination calendar (3-year its DOI).[4,6,7,39] We also consider suitable the monovalent vaccines: Leukemia and Rabies. Leukemia must be always tested beforehand since only should be administered in case of the animal does not suffer this disease, and Rabies should be managed alone to ensure that it can be followed, because it has specific legal considerations in each territory.

On the contrary, we consider unsuitable cats' combined vaccines with Chlamydia with Calicivirus+Herpes virus+Panleukopenia or Leukemia because they could increase the risk of over-vaccination (Chlamydia annually vs. Calicivirus+Herpes virus+Panleukopenia or Leukemia every three years). Likewise, infectious peritonitis monovalent vaccines are also classified as not suitable, since despite the reported studies are limited, they are defined in the guidelines as not recommended, due to the low levels of protection observed.[4,6,7]

Thus, this study considers that with 26.7% of dogs' vaccines (Distemper+Adenovirus+Parvovirus, Bordetella+Parainfluenza, Leptospira and Rabies) and 42.9% of cats' (Calicivirus+Herpes virus+Panleukopenia, Leukemia and Rabies) could be enough to carry out a correct vaccination schedule, and this reveals that not all available vaccines would be necessary, a question commonly raised by veterinarians and owners. As several studies have shown, the correct vaccination is the key to get an adequate immunization of animals avoiding over-vaccination or over-dosage that can cause from ineffectiveness to serious adverse effects.[4,6–8] Both early and too frequent administration, may be ineffective.[38,40] Moreover, it is known that the administration of any vaccine can cause secondary effects at the local level, such as inflammation or edema, or general symptoms such as fever, hypersensitivity, or immunosuppression; when overdosing occurs, the probability of causing these adverse effects is greatly increased.[11] In addition, is well known that over-vaccination implies an extra cost for the owners of the animals who are paying for a vaccine that their pets do not really need.[41] Therefore, our pharmacist approach stablishes the classification by suitable and unsuitable according to our clinical experience in therapeutic committee, evaluating and selecting medicines for our hospital, to ensure the safety and effectivity use of medicines with lowest cost and with the goal of helping in the decision-making process, but not like a substitute for a veterinarian clinical judgment. So, veterinarians must pay special attention to non-suitable combinations that might cause confusion eliciting over-vaccination.

**Datasheets vs guides**

Both guidelines selected (WSAVA and COLAVAC) for the correlation analysis are internationally recognized and have considered epidemiological criteria for these recommendations. The analysis of technical data sheets of authorized and available vaccines in Spain for dogs and cats show that vaccines do not entirely match with international guidelines. Only 30.4% of dog vaccines and 35.7% of cat vaccines match entirely. In addition, this study shows that most combined vaccines, present wrong number of doses, frequency of administration and/or revaccinations compared to guidelines. It is necessary to highlight that only few datasheets of polyvalent vaccines for dogs and cats, describe differences in the duration of immunity between the pathogens contained. Ratifying that the DOI of each pathogen must be taken in care to avoid the risk of overvaccination or under-vaccination. On the contrary, most combinations that include microorganisms that must be revaccinated at least every 3 years, recommend in their data sheets annual revaccinations for both dogs and cats; being this problem more pronounced in vaccines for dogs.[4,6–8] We also see that most combinations that included microorganisms that must be revaccinated at least every 3 years, recommended in their data sheets annual revaccinations for both dogs and cats; being this problem more pronounced in vaccines for dogs.[4,6–8] This situation denotes how the pharmaceutical industry suggests more frequent vaccinations than guidelines in its technical data sheets and regulatory bodies allow it, as other study has shown.[42]

The veterinarian decision process of vaccination against a pathogen is multifactorial and depends on the illness to prevent, the disease prevalence in a particular area or geographical location, pet's lifestyle, or vaccines availability between others, but this variety does not justify the inconsistencies observed between the technical data sheets and the guides.[4,6–8]

In view of the obtained results and given that currently, in Spanish Veterinary medicine does not exist a national consensus to vaccinate companion animals, vaccine administration errors due an incorrect information in vaccines technical data sheets like over-vaccination are demonstrated that might happen. So, we recommend, the authorities request manufacturers to modify and update their data sheets in accordance with guidelines to avoid possible adverse events, as well as, to design an accessible and flexible vaccine schedule, like in human beings, as instrument to inform and educate the population to promote adherence to pets' vaccines.

## CONCLUSION

Only 28.6% of dogs' and 42.9% of cats' vaccines in Spain, are

considered suitable, and 30.4% of dogs' and 35.7% of cats' vaccines data sheets fully agree with guidelines. Thus, we highly suggest, data sheets updating a recommended vaccination schedule and the unification in vaccines nomenclature, totally necessary, from our point of view, to help veterinarians in the clinical decision-making process to vaccinate properly with the lowest risks and minimizing costs, promoting therapeutic adherence and providing a beneficial impact on animals and society.

## ACKNOWLEDGMENTS

The authors wish to thank Rof Codina University Veterinary Hospital its collaboration.

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