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GUIDELINES FOR THE VACCINATION OF DOGS AND CATS

COMPILED BY THE VACCINATION GUIDELINES GROUP (VGG)

OF THE WORLD SMALL ANIMAL VETERINARY ASSOCIATION (WSAVA)

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EXECUTIVE SUMMARY

The WSAVA Vaccination Guidelines Group (VGG) was convened in order to develop guidelines for the vaccination of dogs and cats that have global application. The first version of these guidelines was published in 2007. A survey of WSAVA member nations has indicated the important role these guidelines have played globally. They have been adopted as national policy in some countries where such guidelines did not previously exist, and have been used by other countries as a basis for development of national guidelines. The present document provides an updated and expanded version of these international guidelines for the vaccination of small companion animals. The VGG recognizes that the keeping of pet small animals is subject to significant variation in practice and associated economics throughout the world, and that vaccination recommendations that might apply to a developed country, may not be appropriate for a developing country. Despite this, the VGG strongly recommends that wherever possible ALL dogs and cats receive the benefit of vaccination. This not only protects the individual animal, but provides optimum 'herd immunity' that minimizes the likelihood of an infectious disease outbreak.

With this background in mind, the VGG has defined **core** vaccines which ALL dogs and cats, regardless of circumstances, should receive. Core vaccines protect animals from severe, life-threatening diseases that have global distribution. Core vaccines for dogs are those that protect from canine distemper virus (CDV), canine adenovirus (CAV) and canine parvovirus type 2 (CPV-2). Core vaccines for cats are those that protect from feline parvovirus (FPV), feline calicivirus (FCV) and feline herpesvirus-1 (FHV-1). In areas of the world where rabies virus infection is endemic, vaccination against this agent should be considered core for both species, even if there is no legal requirement for routine vaccination.

The VGG recognizes that maternally derived antibody (MDA) significantly interferes with the efficacy of most current core vaccines administered to pups and kittens in early life. As the level of MDA varies significantly among litters, the VGG recommends the administration of three vaccine doses to pups and kittens, with the final dose of these being delivered at 14–16 weeks of age or above. In cultural or financial situations where a pet animal may only be permitted the benefit of a single vaccination, that vaccination should be with core vaccines at 16 weeks of age or above.

The VGG supports the development and use of simple in-practice tests for determination of seroconversion (antibody) following vaccination.

Vaccines should not be given needlessly. Core vaccines should not be given any more frequently than every three years after the 12 month booster injection following the puppy/kitten series, because the duration of immunity (DOI) is many years and may be up to the lifetime of the pet.

The VGG has defined **non-core** vaccines as those that are required by only those animals whose geographical location, local environment or lifestyle places them at risk of contracting specific infections. The VGG has also classified some vaccines as **not recommended** (where there is insufficient scientific evidence to justify their use) and has not considered a number of minority products which have restricted geographical availability or application.

The VGG strongly supports the concept of the 'annual health check' which removes the emphasis from, and client expectation of, annual revaccination. The annual health check may still encompass administration of selected non-core vaccines which should be administered annually, as the DOI for these products is generally one year or less.

The VGG has considered the use of vaccines in the shelter environment, again recognizing the particular nature of such establishments and the financial constraints under which they operate. The VGG minimum shelter guidelines are simple: that all dogs and cats entering such an establishment should be vaccinated before, or at the time of entry, with core vaccines only. Where finances permit, repeated core vaccination should be administered as per the schedules defined in the guidelines.

The VGG recognizes the importance of adverse reaction reporting schemes but understands that these are variably developed in different countries. Wherever possible, veterinarians should be actively encouraged to report all possible adverse events to the manufacturer and/or regulatory authority to expand the knowledge base that drives development of improved vaccine safety.

These fundamental concepts proposed by the VGG may be encapsulated in the following statement:

We should aim to vaccinate every animal with core vaccines, and to vaccinate each individual less frequently by only giving non-core vaccines that are necessary for that animal.

INTRODUCTION

The WSAVA Vaccination Guidelines Group (VGG) was convened in 2006 with the responsibility of producing global vaccination guidelines for dogs and cats that would consider international differences in economic and societal factors that impact on the keeping of these small companion animals. They were launched at the 2007 WSAVA Congress and contemporaneously published in the *Journal of Small Animal Practice* (Day et al., 2007). English and Spanish versions were made publicly available on the WSAVA website.

With recognition that this is a rapidly developing field of companion animal medicine, the VGG was reconvened in 2009 with the targets of (1) updating the 2007 guidelines for veterinarians and (2) preparing a new set of guidelines directed at the owners and breeders of dogs and cats. The VGG has met on three occasions during 2009–2010 and has had active electronic communication between these meetings. The present document represents the conclusion of the first target, and the VGG is well progressed towards the launch of owner-breeder guidelines in 2010.

The first activity of this second phase of the VGG was to assess the impact of the 2007 guidelines on the international veterinary community. To achieve this goal, it developed a simple questionnaire that was circulated to all 70 WSAVA member countries through their WSAVA Assembly representatives. The following questions were asked:

1. Were the 2007 guidelines widely available to veterinarians in your country?
2. Were the 2007 guidelines discussed by your national small animal veterinary association?
3. Does your national small animal veterinary association have its own guidelines for the vaccination of dogs and cats?
4. If not, has your national small animal veterinary association adopted the WSAVA guidelines?
5. Is there any significant conflict between the WSAVA guidelines and national practices in companion animal medical care?

Each country that had its own vaccination guidelines was also asked to send a copy of these to the VGG.

Responses were received from 27 countries, both from developed and developing nations. The 2007 guidelines were generally accessible by the veterinary community (for 18 of 27 respondents); where this was not the case, the reason was most often the unavailability of a translated version. Notably, the lack of computers and internet access in general practice was also flagged by some developing nations. The 2007 guidelines had been discussed by the small animal veterinary associations of 12 of 27 respondent countries. Thirteen of 27 respondent countries already had national guidelines in place or in the case of some smaller European countries - had adopted those used by a larger neighbour. The VGG was privileged to be able to assess six of these national guidelines documents, which ranged from excellent succinct summaries to very detailed and substantial papers that provided solid background discussion of immunology and vaccination.

The VGG was pleased to note that in 12 of 14 countries without vaccination guidelines, the national organizations had either fully adopted or recommended the WSAVA guidelines or were currently using them to develop their own national recommendations. It is also clear that in some countries, publication of the guidelines had precipitated discussion by national organizations that had sometimes been driven by pressure from the general public. Most respondents indicated a range of minor conflicts between the WSAVA guidelines and national practice, but these were not as great as anticipated. For example, many countries maintain legal annual revaccination for rabies, some countries do not have access to the full range of products listed in the guidelines (e.g. individual component products or extended DOI products), and others have specific national products from local manufacturers that are not globally available.

The responses to this questionnaire underline the importance of global vaccination guidelines and of their current revision. The aim of this document is to update and extend the information given in the 2007 version; while much of the text and recommendations will remain the same, specific changes are:

1. A clear indication of the purpose of a guidelines document.
2. A discussion of passive immunization, in particular for canine distemper virus (CDV) infection.
3. Preliminary assessment of vaccines for canine influenza virus (CIV), leishmaniosis and malignant melanoma.
4. Discussion of differences in approach to feline upper respiratory virus (FHV-1 and FCV) and feline leukaemia virus (FeLV) vaccination.
5. Recommendations for sites of vaccination for cats.

6. An update on cross-protection for canine parvovirus (CPV) 2c.
7. A new fact sheet on rabies vaccines.
8. An expanded list of 60 frequently asked questions (FAQs). Feedback suggested that this aspect of the 2007 guidelines document was particularly useful to practitioners.
9. An image bank of major canine and feline vaccine-preventable diseases. The VGG believes that these images will be of great value to the practicing veterinarian during the 'vaccination interview' with clients. The images are freely available via the WSAVA website and provide visual evidence of the significance and severity of infectious diseases that may be prevented by vaccination. The images may be used in the consultation room whilst addressing the 'risk-benefit' of vaccination with pet owners.

The VGG again acknowledges the important work undertaken by the American Animal Hospital Association (AAHA) Canine Vaccine Task Force (Paul et al., 2006) and the American Association of Feline Practitioners (AAFP) Feline Vaccine Advisory Panel (Richards et al., 2006) in addressing companion animal vaccination issues. Since publication of the 2007 WSAVA guidelines, the European Advisory Board on Cat Diseases (ABCD) has also formulated recommendations for feline vaccination from the European perspective, and the work of this group has recently cumulated in publication of a special issue of the *Journal of Feline Medicine and Surgery* (Horzinek and Thiry, 2009).

THE PURPOSE OF GUIDELINES

In speaking to practitioner audiences about the 2007 guidelines it is clear that there is widespread confusion about their purpose. Many practitioners are initially alarmed that the recommendations appear contrary to those given on the product data sheet, and therefore feel that if they adopt guidelines recommendations, they are leaving themselves open to litigation. The distinct difference between a data sheet and guidelines document has been clearly discussed in a recent paper (Thiry and Horzinek, 2007).

A data sheet (or 'summary of product characteristics'; SPC) is a legal document that forms part of the registration process for a vaccine. A data sheet will give details of the quality, safety and efficacy of a product and in the case of vaccines will describe the legal DOI of the product. The legal DOI is based on experimental evidence, represents a minimum value and need not reflect the true DOI of a vaccine. Most companion animal vaccines, until recently, had a 1 year DOI and carried a recommendation for annual revaccination. The sensible response of industry to recent discussions about vaccine safety has been to increasingly license products with an 'extended' (generally 3 year) DOI. However, for most core vaccines (see below) the true DOI is likely to be considerably longer.

There are instances, where the guidelines may recommend a triennial vaccination with a product that still carries a 1 year licensed DOI. The simple reason for this is that the guidelines are based on **current** scientific knowledge and thinking, whereas the data sheet reflects the knowledge available at the time that the vaccine received its original license (which may be more than 20 years earlier). Consequently, guidelines advice will often differ from that given in the data sheet; however, any veterinarian may use a vaccine according to guidelines (and therefore current scientific thinking) by obtaining informed (and documented) owner consent for this deviation from legal recommendations ('off-label use'). Further confusion is often caused by company representatives who will advise, as they are legally obliged to do, that the veterinarian must adhere to the data sheet recommendation.

A further point of confusion arises where veterinarians compare the recommendations given in different sets of guidelines. There are, for example, subtle differences in recommendations made in the USA and Europe that reflect differences in the opinions of local expert groups and in the perception of lifestyles of pet animals that may make them more or less exposed to infections. The VGG faces the difficult challenge of setting a middle-course through various national or regional guidelines. Its recommendations attempt to provide a balanced perspective to account for global differences in the keeping of small companion animals.

In summary, veterinarians should feel comfortable about vaccinating according to the schedules given in these guidelines but should cross-reference these with local recommendations where available. Where the VGG recommendations differ from current legal requirements, the practitioner need only obtain informed client consent to provide that client, and the animal, with a current evidence-based vaccination schedule.

If vaccination has been so successful, then why is it necessary to continually re-evaluate vaccination practice? There is little doubt that in most developed countries the major infectious diseases of dogs and cats are considered at best uncommon in the pet population, but there do remain geographical pockets of infection and sporadic outbreaks of disease occur, and the situation regarding feral or shelter populations is distinctly different to that in owned pet animals. However, in many developing countries these key infectious diseases remain as common as they once were in developed nations and a major cause of mortality in small animals. Although it is difficult to obtain accurate figures, even in developed countries it is estimated that only 30–50% of the pet animal population is vaccinated, and this is significantly less in developing nations. In small animal medicine, we have been slow to grasp the concept of 'herd immunity'–that vaccination of individual pet animals is important, not only to protect the individual, but to reduce the number of susceptible animals in the regional population, and thus the prevalence of disease. Herd immunity with the core vaccines that provide a long (many years) DOI is highly dependent on the percentage of animals in the population vaccinated and not the number of vaccinations that occur annually. Therefore, every effort should be made to vaccinate a higher percentage of cats and dogs with the core vaccines.

A second major concept regarding vaccination of dogs and cats has been the recognition that we should aim to reduce the 'vaccine load' on individual animals in order to minimize the potential for adverse reactions to vaccine products. For that reason we have seen the development of vaccination guidelines based on a rational analysis of the vaccine requirements for each pet, and the proposal that vaccines be considered 'core' and 'non-core' in nature. To an extent this categorization of products has been based on available scientific evidence and personal experience – but concerted effort to introduce effective companion animal disease surveillance on a global scale would provide a more definitive basis on which to recommend vaccine usage. In parallel with the categorization of vaccines has been the push towards marketing products with extended DOI, to reduce the unnecessary administration of vaccines and thereby further improve vaccine safety. Both of these changes have necessitated a frame-shift in the mindset of veterinary practitioners in a culture in which both veterinarian and client have become subservient to the mantra of annual vaccination.

The following VGG guidelines are prepared when considering the optimum model of a committed pet owner, willing and able to bring their animal to the veterinarian, for the full recommended course of vaccination. The VGG is aware that there are less committed pet owners and countries where severe financial or societal constraints will determine the nature of the vaccine course that will be administered. In situations where, for example, a decision must be made that an individual pet may have to receive only a single core vaccination during its lifetime, the VGG would emphasize that this should optimally be given at a time when that animal is most capable of responding immunologically, i.e. at the age of 16 weeks or greater.

The VGG has additionally considered vaccination in the shelter situation. The guidelines that we have proposed are those that we consider provides the optimum level of protection for these highly susceptible animals. The VGG also recognizes that many shelters run with limited financial support which may constrain the extent of vaccination used. The minimum vaccination protocol in this situation would be a single administration of core vaccines at or before the time of admission to the shelter.

This document seeks to address these current issues in canine and feline vaccinology, and to suggest practical measures by which the veterinary profession may move towards more rational use of vaccination in these species. The most important message of the VGG is therefore encapsulated in the following statement:

We should aim to vaccinate every animal with core vaccines, and to vaccinate each individual less frequently by only giving non-core vaccines that are necessary for that animal.

VACCINATION OF INDIVIDUAL DOGS

The Basic Immunization Schedule

Guidelines and recommendations for core (recommended), non-core (optional), and not recommended vaccines for the general veterinary practice are given in Table 1. The VGG considers that a core vaccine is one that all puppies throughout the world must receive in order to provide protection against infectious diseases of global significance. The VGG recognizes that particular countries will identify additional vaccines that they consider core. A particular example of a vaccine that may be considered core in only some countries is that against rabies virus. In a geographical area in which this infection is endemic all dogs should be routinely vaccinated for the protection of both the pet and human populations. In some countries, mandatory rabies vaccination is a legal requirement, and is generally also required for international pet travel. Non-core vaccines are those that are licensed for the dog and whose use is determined on the basis of the animal's geographical and lifestyle exposure and an assessment of risk-benefit ratios. Not recommended vaccines are those for which there is little scientific justification for their use.

Pup Vaccination and the 12 Month Booster

Most pups are protected by MDA in the first weeks of life. In general, passive immunity will have waned by 8–12 weeks of age to a level that allows active immunization. Pups with poor MDA may be vulnerable (and capable of responding to vaccination) at an earlier age, while others may possess MDA at such high titres that they are incapable of responding to vaccination until ≥ 12 weeks of age. No single primary vaccination policy will therefore cover all possible situations. The recommendation of the VGG is for initial vaccination at 8–9 weeks of age followed by a second vaccination 3–4 weeks later, and a third vaccination given between 14–16 weeks of age. By contrast, at present many vaccine data sheets recommend an initial course of two injections. Some products are also licensed with a '10 week finish' designed such that the second of two vaccinations is given at 10 weeks of age. The rationale behind this protocol is to permit 'early socialization' of pups. The VGG recognizes that this is of great benefit to the behavioural development of dogs. Where such protocols are adopted, great caution should still be maintained by the owner – allowing restricted exposure of the pup to controlled areas and only to other pups that are healthy and fully vaccinated. The VGG recommends that whenever possible a third dose of core vaccine be given at 14–16 weeks of age.

In immunological terms, the repeated injections given to pups in their first year of life do not constitute boosters. They are rather attempts to induce a primary immune response by injecting the attenuated virus (of modified live virus [MLV] vaccines) into an animal devoid of neutralizing antibody, where it must multiply to be processed by an antigen presenting cell and stimulate antigen-specific T and B lymphocytes. In the case of killed (inactivated) vaccines, MDA may also interfere with this immunological process by binding to and 'masking' the relevant antigens. Here repeated doses are required.

All dogs should receive a first booster 12 months after completion of the primary vaccination course. The VGG redefines the basic immunization protocol as the ensemble of the pup regime plus this first booster. The 12 month booster will also ensure immunity for dogs that may not have adequately responded to the pup vaccinations.

Revaccination of Adult Dogs

Dogs that have responded to vaccination with MLV core vaccines maintain a solid immunity (immunological memory) for many years in the absence of any repeat vaccination. Following the 12 month booster, subsequent revaccinations are given at intervals of 3 years or longer, unless special conditions apply. It should be emphasized that the considerations given above do not generally apply to killed core vaccines nor to the optional vaccines, and particularly not to vaccines containing bacterial antigens. Thus *Leptospira*, *Bordetella* and *Borrelia* (Lyme disease) products, but also parainfluenza virus components, require more frequent boosters for reliable protection.

Therefore an adult dog may today still be revaccinated annually, but the components of these vaccinations may differ each year. Typically, core vaccines are currently administered triennially, with chosen non-core products being given annually. The VGG is aware that in some countries only multi-component products containing core and non-core combinations are available. The VGG would encourage manufacturers to make a full range of single-component vaccines available wherever possible.

An adult dog that had received a complete course of core vaccinations as a puppy followed by the 12 month booster, but may not have been regularly vaccinated as an adult, requires only a single dose of core vaccine to boost immunity. Many current data sheets

will advise in this circumstance that the dog requires two vaccinations (as for a puppy) but this practice is unjustified and simply contrary to the fundamental principles of immunological memory. By contrast, this approach may be justified for an adult dog of unknown vaccination history, and when serological testing has not been performed.

Serological Testing to Monitor Immunity to Canine Vaccines

Antibody tests are useful for monitoring immunity to CDV, CPV-2, CAV-1 and rabies virus. Antibody assays for CDV and CPV-2 are the tests of greatest benefit in monitoring immunity, especially after the puppy vaccination series. During recent years, many laboratories have standardized their methodologies for such testing. There are legal requirements for rabies antibody testing for pet travel between some countries.

In-practice testing will probably become more popular as soon as rapid, simple, reliable and cost-effective assays are more widely available. A negative test result indicates that the animal has little or no antibody, and that revaccination is recommended. Some of these dogs are in fact immune (false-negative), and their revaccination would be unnecessary. A positive test result on the other hand would lead to the conclusion that revaccination is not required. This is why robust yes/no answers must be provided by any assay. With CDV and/or CPV-2 tests, an animal with a negative result, regardless of the test used, should be considered as having no antibody and susceptible to infection.

On completion of the puppy series at 14–16 weeks of age, an animal should have a positive test result, provided the serum sample is collected 2 or more weeks after vaccination. Seronegative animals should be revaccinated and retested. If it again tests negative, it should be considered a non-responder that is possibly incapable of developing protective immunity.

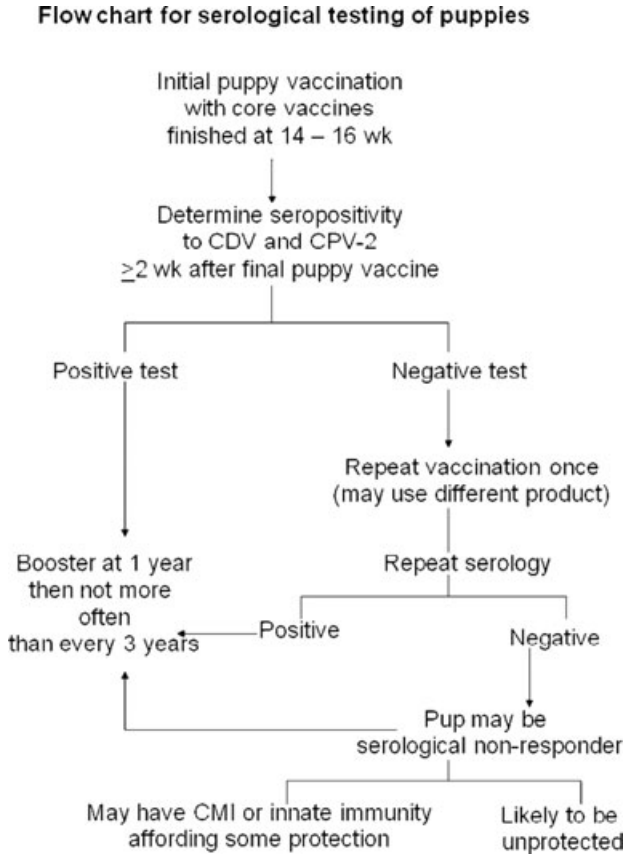

Figure 1. Flow Chart for Serological Testing of Puppies. CMI = cell-mediated immunity.

Testing for antibody is presently the only practical way to ensure that a puppy's immune system has recognized the vaccinal antigen. Vaccines may fail for various reasons:

(1) MDA neutralizes the vaccine virus

This is the most common reason for vaccination failure. However, when the last vaccine dose is given at 14–16 weeks of age, MDA should have decreased to a low level, and active immunization will succeed in most puppies (>98%).

(2) The vaccine is poorly immunogenic

Poor immunogenicity may reflect a range of factors from the stage of vaccine manufacture to administration to the animal. For example, the virus strain, its passage history or production errors in the manufacture of a particular batch of product may be a cause of vaccine failure. Post-manufacture factors such as incorrect storage or transportation (interrupted cold chain) and handling (disinfectant use) of the vaccine in the veterinary practice, may result in inactivation of an MLV product.

(3) The animal is a poor responder (its immune system intrinsically fails to recognize the vaccinal antigens)

If an animal fails to develop an antibody response after repeated revaccination, it should be considered a non-responder. Because immunological non-responsiveness is genetically controlled in other species, certain breeds of dogs have been suspected to be poor-responders. It is believed (but unproven) that the high susceptibility to CPV-2 recognized in certain Rottweilers and Dobermans during the 1980s (regardless of their vaccination history) was due to a high prevalence of non-responders. In the USA today, these two breeds seem to have no greater numbers of non-responders to CPV-2 than other breeds, possibly because carriers of the genetic trait may have died from CPV-2 infection. Some dogs of these breeds may be low or non-responders to other antigens. For example, in the UK and Germany, the non-responder phenotype is prevalent amongst Rottweilers for CPV-2 and rabies virus as recent studies have shown this breed to have a higher proportion of animals failing to achieve the titre of rabies antibody required for pet travel.

Serological Testing to Determine the Duration of Immunity (DOI)

Most vaccinated dogs will have a persistence of serum antibody (against core vaccine antigens) for many years. Immunologically, this antibody reflects the function of a distinct population of long-lived plasma cells (memory effector B cells). Induction of immunological memory is the primary objective of vaccination. For core vaccines there is excellent correlation between the presence of antibody and protective immunity and there is long DOI for these products. This correlation does not exist for many of the non-core vaccines and the DOI related to these products necessitates more frequent revaccination intervals.

Antibody tests can be used to demonstrate the DOI after vaccination with core vaccines. It is known that dogs often maintain protective antibody to CDV, CPV-2, CAV-1, and CAV-2 for three or more years and numerous experimental studies support this observation. Therefore, when antibody is absent (irrespective of the serological test used) the dog should be revaccinated unless there is a medical basis for not so doing. Antibody determinations to other vaccine components are of limited or no value because of the short time period these antibodies persist (e.g. *Leptospira* products) or the lack of correlation between serum antibody and protection (e.g. *Leptospira* or canine parainfluenza). Important considerations in performing antibody tests are the cost and the time to obtain results.

The VGG recognizes that at present such serological testing has limited availability and might be relatively expensive. However, the principles of 'evidence-based veterinary medicine' would dictate that testing for antibody status (for either pups or adult dogs) is a better practice than simply administering a vaccine booster on the basis that this should be 'safe and cost less'. In response to these needs, more rapid, cost-effective tests are being developed.

Passive Immunization

While vaccination (i.e. active immunization) dominates infectious disease prevention, passive immunization also has a venerable history, from the first anti-diphtheria serum to hyperimmune sera available for protecting human infants against anthrax, botulism, and scarlet fever, and adults against varicella-zoster, respiratory syncytial virus, hepatitis A and B, mumps, measles and rabies.

Although virus infections trigger both cellular and humoral immunity, it is mainly the antibody response that contributes to the reduction of viral load and recovery. In many virus infections, antibody levels are therefore taken as correlates of protection. During viraemia, pre-existing or injected antibodies directed against surface structures of virions latch on to the particles, neutralize their infectivity and prepare them for removal. Therapeutically, the serum or immunoglobulin preparations are injected subcutaneously and quickly reach the circulation. Not unexpectedly, intravenous infusions of plasma (not serum) have been found to work as well but this is a more difficult practice that must be used with caution. In local infections, such as those initiated by the bite wound of a rabid carnivore, post-exposure antibody prophylaxis has also proven invaluable. Human rabies immune globulin provides rapid protection

when given on the first day of the post-exposure prophylaxis regimen. As much as possible of the preparation is infiltrated into and around the wound, and may be given intramuscularly at a site distant from the rabies vaccine, which is applied simultaneously.

In companion animal practice, preventive active immunization is so commonplace that serum prophylaxis/therapy is considered only under exceptional circumstances (e.g. when a dog is presented with distemper or a cat is presented with panleukopenia, or during a disease outbreak in a kennel/cattery). There is still a market for serum and immunoglobulin products, and companies producing them exist in the USA, Germany, the Czech Republic, Slovakia, Russia and Brazil. The preparations are either of homologous or heterologous (horse) origin, are polyvalent (directed against several viruses) and consist of sera or their immunoglobulin fraction.

Despite the availability of such products, the VGG recommends that they be used conservatively, and only after careful consideration. In the case of an outbreak of CDV infection in a kennel it is much safer and more effective to vaccinate all dogs with CDV vaccine rather than giving immune serum. In such a situation it has previously been recommended that MLV vaccines be administered intravenously rather than subcutaneously or intramuscularly, but there is little evidence that this practice provides more effective protection than subcutaneous injection. Administration of CDV vaccines by any of those routes will provide protection from severe disease and death immediately after vaccination. In this instance the vaccine does not prevent infection, but instead it protects from disease (especially from neurological disease) so the animal will survive and will subsequently be immune for life.

In the case of a cattery outbreak of FPV infection, or a kennel outbreak of CPV-2 infection, recent experience has shown that if immune serum is given after clinical signs appear, there is no benefit in reduction of morbidity or mortality. In order to have a beneficial effect, immune serum must be given after infection, but prior to the onset of clinical signs. In this case administration of immune serum must be within 24–48 hours after infection and a large amount of very high titred serum is required. The serum must be given parenterally (e.g. subcutaneously or intraperitoneally) and not orally. There is no benefit from oral administration even when treatment is started prior to infection.

An important consideration in a shelter situation is the relative cost of these commercial products. An alternative practice that is sometimes used in a shelter situation is to collect serum from animals in the shelter that have survived disease or have been recently vaccinated. However, this practice carries risk as the serum will not necessarily have been screened for transmissible pathogens (e.g. haemoparasites or feline retroviruses).

A more effective approach to controlling disease outbreaks in a shelter situation would be through the use of serological testing. Determination of serum antibody titres can identify those animals that are protected (and can therefore safely be left in the shelter in the face of a disease outbreak) and those animals that are susceptible (and are therefore likely to become infected and possibly die) and therefore should be euthanized. If the susceptible population is not euthanized, those animals should be isolated and not be adopted or fostered until it is certain that they are not infected.

New Canine Vaccines

New canine vaccines are becoming available in some countries, and although the scientific literature assessing these products and their application is limited, the VGG has given preliminary consideration to some of them. It should be emphasized that these may not be fully licensed products and have limited regional availability.

A new vaccine against **canine influenza virus** (CIV) infection received conditional license in the USA in June 2009. The influenza A subtype H3N8 has been a particular problem in North America in animals that are housed together, but to date only sporadic cases have been recognized elsewhere (Europe). The CIV vaccine contains inactivated virus and is administered to pups from 6 weeks of age with a booster 2–4 weeks later and then annual revaccination. Immunity develops approximately 7 days after the second dose. The vaccine is considered non-core and is recommended only for at-risk dogs that are likely to encounter group exposure as part of their lifestyle.

The first canine immunotherapeutic vaccine for **malignant melanoma** received conditional license in the USA in March 2007 and was fully licensed in 2010. This product comprises the human tyrosinase gene incorporated into a plasmid (a 'naked DNA' vaccine) that is repeatedly delivered by use of a high-pressure transdermal injection device. The vaccine, which is used in dogs that receive traditional treatments for oral melanomas, induces an immune response to this melanoma target antigen, and studies show that the median survival time of dogs with grade II–IV melanoma increased to 389 days (from an expected survival of 90 days) (Bergman et al., 2006). The vaccine has also recently become available in Europe and, as in the USA, is limited to use by recognized veterinary oncology specialists.

An increasing body of scientific literature has now evaluated the first licensed vaccine for canine **leishmaniosis**. This product is licensed only in Brazil, where leishmaniosis is a disease of major importance to the canine and human population. There is an active programme of culling seropositive infected dogs to reduce the reservoir population. The vaccine is a subunit product containing GP63 of *L. donovani* (also known as the 'fucose mannose ligand') in saponin adjuvant. It is considered to induce antibody that

blocks the transmission of the organism from the dog to the sand fly vector by preventing binding of *Leishmania* to the midgut of the sand fly. The vaccine appears compatible with serological testing to identify infected dogs, as only 1.3% of 5860 vaccinated uninfected animals were positive in the tests used in that screening programme. More importantly, large scale epidemiological studies have shown that vaccination has an additive effect to the culling programme with regions having high uptake of vaccination showing reduced incidence of both canine and human infection (Palatnik de Sousa et al., 2009). These findings add support to the concept that this vaccine might be considered core in a country such as Brazil.

Table 1 WSAVA Canine Vaccination Guidelines

Vaccine	Initial Puppy Vaccination (≤ 16 weeks)	Initial Adult Vaccination (> 16 weeks)	Revaccination Recommendation	Comments and Recommendations *See text for definitions of core, non-core and not recommended vaccines*
Canine Parvovirus-2 (CPV-2; MLV, parenteral) Canine Distemper Virus (CDV; MLV, parenteral) Recombinant Canine Distemper Virus (rCDV, parenteral) Canine Adenovirus-2 (CAV-2; MLV, parenteral)	Administer at 8–9 weeks of age, then every 3–4 weeks until 14–16 weeks of age.	Two doses, 3–4 weeks apart are generally recommended by manufacturers but one dose is considered protective.	Revaccination (booster) at 1 year, then not more often than every 3 years.	Core
CAV-2 (MLV, intranasal)				Parenteral preferred for enhanced immunity to CAV-1.
CPV-2 (killed, parenteral)				Not recommended where MLV available
Canine Adenovirus-1 (CAV-1; MLV and killed parenteral)				Not Recommended where CAV-2 MLV available
Rabies (killed parenteral)	Administer one dose as early as 3 months of age. *In high risk areas and if permitted by law, give a second dose 2–4 weeks after the first dose	Administer a single dose.	Canine rabies vaccines with either a 1- or 3-year DOI are available. Timing of boosters is determined by this licensed DOI but in some areas may be dictated by statute.	Core where required by statue or in areas where the disease is endemic.
Parainfluenza Virus (CPiV; MLV, parenteral)	Administer at 8–9 weeks of age, then every 3–4 weeks until 14–16 weeks of age.	Two doses, 3–4 weeks apart are generally recommended by manufacturers but one dose is considered protective.	Revaccination (booster) at 1 year, then annually where CPiV is monovalent or combined with other non-core components.	Non-core. Use of CPiV (MLV-intranasal) is preferred to the parenteral product as the primary site of infection is the upper respiratory tract.
CPiV (MLV, intranasal)	Administer as early as 3 weeks of age and revaccinate within 3–4 weeks.	Two doses, 3–4 weeks apart.	Revaccination (booster) at 1 year, then annually	Non-core. This product is generally combined with intranasal *Bordetella bronchiseptica* and this product should be administered annually following the puppy series.
Bordetella bronchiseptica (live avirulent bacteria, intranasal)	Administer a single dose as early as 3 weeks of age. For best results, a second dose should be given 2–4 weeks after the first.	A single dose.	Annually or more often in very high-risk animals not protected by annual booster.	Non-core. This product is generally combined with intranasal CPiV. Transient (3–10 days) coughing, sneezing, or nasal discharge may occur in a small percentage of vaccinates.
Bordetella bronchiseptica (killed bacterin, parenteral) *Bordetella bronchiseptica* (cell wall antigen extract, parenteral)	Administer one dose at 6–8 weeks and one dose at 10–12 weeks of age.	Two doses, 2-4 weeks apart.	Annually or more often in very high-risk animals not protected by annual booster.	Non-core. The MLV intranasal product is preferred to the killed parenteral to provide local and systemic protection.

Table 1 Continued

Vaccine	Initial Puppy Vaccination (≤ 16 weeks)	Initial Adult Vaccination (> 16 weeks)	Revaccination Recommendation	Comments and Recommendations *See text for definitions of core, non-core and not recommended vaccines*
Borrelia burgdorferi (Lyme borreliosis; killed whole bacterin, parenteral) *Borrelia burgdorferi* (rLyme borreliosis) (recombinant-Outer surface protein A [OspA], parenteral)	Recommendation is for initial dose at 12 weeks of age or older after completion of the puppy core viral vaccines with a second dose 2–4 weeks later.	Two doses, 2–4 weeks apart.	Annually. Revaccinate just prior to start of tick season as determined regionally.	Non-core. The VGG recommends that this vaccine not be administered before 12 weeks of age and preferably after completion of the core series of puppy vaccines. Generally recommended only for use in dogs with a known high risk of exposure, living in or visiting regions where the risk of vector tick exposure is considered to be high, or where disease is known to be endemic.
Leptospira interrogans (combined with serovars canicola and icterohaemorrhagiae; killed bacterin, parenteral) (also available in the USA with serovars grippotyphosa and pomona)	Initial dose at 12–16 weeks of age or older after completion of the puppy core viral vaccines with a second dose 3–4 weeks later	Two doses 3–4 weeks apart, then annually or more often.		Non-core. Vaccination should be restricted to use in geographical areas where a significant risk of exposure has been established or for dogs whose lifestyle places them at significant risk. These dogs should be vaccinated at 12–16 weeks of age, with a second dose 3–4 weeks later, and then at intervals of 9–12 months until the risk has been reduced. This vaccine is the one least likely to provide adequate and prolonged protection, and therefore must be administered annually or more often for animals at high risk. Protection against infection with different serovars is variable. This product is associated with the greatest number of adverse reactions to any vaccine. In particular, veterinarians are advised of reports of acute anaphylaxis in toy breeds following administration of leptospirosis vaccines. Routine vaccination of toy breeds should only be considered in dogs known to have a very high risk of exposure.
Canine influenza virus (CIV; killed adjuvanted, parenteral)	Two doses 2–4 weeks apart with initial dose at >6 weeks of age	Two doses, 2–4 weeks apart	Annually	Non-core. Conditional license only in USA. Consider for at-risk groups of co-housed dogs such as those in kennels, dog shows or day care.
Canine Coronavirus (CCV; killed and MLV, parenteral)				Not Recommended. Prevalence of clinical cases of confirmed CCV disease does not justify vaccination.

The VGG did not consider the following products:

- *Crotalus atrox* toxoid (rattlesnake vaccine)—Conditional USDA License
- *Porphyromonas sp.* (periodontal disease vaccine)—Conditional USDA License
- *Babesia vaccine* (soluble parasite antigen from *B. canis* in saponin)—EU Licensed
- *Babesia* vaccine (soluble parasite antigen from *B. canis canis* and *B. canis rossi* in saponin)—EU Licensed
- Canine herpesvirus vaccine—EU Licensed

The killed parenteral *Giardia lamblia* vaccine for the dog (listed in the 2007 guidelines) is no longer available.

Table 2 WSAVA Guidelines on Canine Vaccination for the Shelter Environment

Recommended Vaccines in Various Combinations (also refer to Table 1)	Initial Vaccine Series for Puppies (<16 weeks of age)	Initial Vaccine Series for Adults (>16 weeks of age)	Comments
CDV + CAV-2 + CPV-2 (MLV) with or without CPiV **r**CDV + CAV-2 + CPV-2 (rCDV + MLV) with or without CPiV Combination product is administered SQ or IM according to manufacturer's recommendations.	Administer one dose prior to or immediately on admission. Repeat at 2 week intervals until 16 weeks of age if animal is still in the facility. Note: Where CDV and/or parvovirus infection rates are high, the CDV vaccine may be administered as early as 4 weeks of age but not earlier.	Administer one dose prior to or immediately on admission. Repeat in 2 weeks.	Ideally puppies should be vaccinated beginning at 6 weeks of age. Nursing history is not always available. In the face of an outbreak, vaccination as early as 4 weeks (for distemper or parvovirus) may be indicated. MDA, if present, can interfere with immunization.

Table 2 Continued

Recommended Vaccines in Various Combinations (also refer to Table 1)	Initial Vaccine Series for Puppies (<16 weeks of age)	Initial Vaccine Series for Adults (>16 weeks of age)	Comments
Bordetella bronchiseptica (avirulent live bacterin) + CPiV (MLV) **For intranasal use only. Parenteral administration MUST BE avoided.**	Administer a single dose as early as 3 weeks of age. For best results, if administered prior to 6 weeks of age, an additional dose should be given after 6 weeks of age.	Two doses 2–4 weeks apart are recommended.	Intranasal (avirulent live) vaccine is preferred to parenteral vaccine in puppies because it can safely be administered to puppies younger than 6 weeks. Additionally a single dose may be protective.
Bordetella bronchiseptica (available as killed bacterin or antigen extract; for parenteral administration only)	Administer one dose at time of admission. Administer a second dose 2–4 weeks later.	Two doses 2–4 weeks apart are recommended.	Topical vaccination in adult dogs or puppies older than 16 weeks has the advantage of providing non-specific immunity immediately after vaccination whereas parenteral does not. Canine respiratory disease complex (kennel cough) is not a vaccine-preventable disease and the vaccine should only be used to help manage the disease.
Canine influenza virus (CIV; available as killed parenteral vaccine)	Administer first dose not earlier than 6 weeks of age, followed in 2–4 weeks by the second dose.	Administer two doses 2–4 weeks apart.	Annual revaccination is recommended for animals in long-stay shelters. For influenza vaccines in general immunity is serotype-specific. This product is only available in the USA.
Rabies	If at all, a single dose, or two doses 2–4 weeks apart in a highly endemic area, should be administered *at the time of discharge* from the facility.	If at all, a single dose should be administered *at the time of discharge* from the facility.	The administration of rabies vaccine will be determined by whether the shelter is in a country in which the disease is endemic, and by local statute.

FELINE VACCINATION GUIDELINES

VACCINATION OF INDIVIDUAL CATS

The Basic Immunization Schedule

Guidelines and recommendations for core (recommended), non-core (optional) and not recommended vaccines for the general veterinary practice are given in Table 3. A particular example of a vaccine that may be considered core in only some countries is that against rabies virus. In a geographical area in which this infection is endemic all cats should be routinely vaccinated for the protection of both the pet and human populations. In some countries, mandatory rabies vaccination is a legal requirement, and is generally also required for international pet travel. In terms of feline core vaccines it is important to realize that the protection afforded by the FCV and FHV-1 vaccines will not provide the same efficacy of immunity as seen with the FPV vaccines. Thus the feline core vaccines should not be expected to give the same robust protection, nor the duration of immunity, as seen with canine core vaccines.

Although the FCV vaccines have been designed to produce cross-protective immunity against severe clinical disease, there are multiple strains of FCV and it is possible for infection and mild disease to occur in the vaccinated animal. With respect to FHV-1, it should be remembered that there is no herpesvirus vaccine that can protect against infection with virulent virus, and that virulent virus will become latent and may be reactivated during periods of **severe** stress. The reactivated virus may cause clinical signs in the vaccinated animal or the virus can be shed to susceptible animals and cause disease in them. The VGG has adopted the recommendation of triennial revaccination for FHV-1 and FCV but appreciates that this is a point of debate amongst experts. For example, the ABDC recommends annual revaccination for cats considered at high risk, but triennial revaccination for low risk (predominantly indoor) animals.

Vaccination against feline leukaemia virus (FeLV) is also often a point of debate amongst experts. The VGG regards FeLV as a non-core vaccine (Table 3) but fully appreciates that use of this product may be determined by the lifestyle and perceived exposure risk of individual cats and the prevalence of infection in the local environment. Many feline experts believe that even though the prevalence of FeLV infection is now markedly reduced due to successful vaccination and control programmes, any cat less than 1 year old with an element of outdoor lifestyle should receive the benefit of protection by routine vaccination with 2 doses of vaccine given 3–4 weeks apart, starting not earlier than 8 weeks of age. This 'risk-benefit' analysis for FeLV should form a routine part of the feline vaccination interview.

Kitten Vaccination and the 12 Month Booster

As discussed for pups, most kittens are protected by MDA in the first weeks of life. However, without serological testing, the level of protection and the point at which the kitten will become susceptible to infection and/or can respond immunologically to vaccination is unknown. This is related to the level of maternal antibody and variation in uptake of MDA between litters. In general, MDA will have waned by 8–12 weeks of age to a level that allows an active immunological response, and an initial vaccination at 8–9 weeks of age followed by a second vaccination 3–4 weeks later is commonly recommended. Many vaccines carry data sheet recommendations to this effect. However, kittens with poor MDA may be vulnerable (and capable of responding to vaccination) at an earlier age, while others may possess MDA at such high titres that they are incapable of responding to vaccination until sometime after 12 weeks of age. Therefore the VGG recommends administration of the final kitten dose at 14–16 weeks or older.

All kittens should receive the core vaccines. A minimum of three doses: one at 8–9 weeks of age, a second 3–4 weeks later and a final dose at 14–16 weeks of age or older should be administered. Cats that respond to MLV core vaccines maintain immunity for many years, in the absence of any repeat vaccination.

Revaccination of Adult Cats

All cats should receive a first booster within 12 months after completion of the kitten vaccination course (this will ensure adequate vaccine-induced immunity for cats that may not have adequately responded to the primary course). Following this first booster, subsequent revaccinations are given at intervals of 3 years or longer, unless special conditions apply. Adult cats of unknown vaccination status should receive a single initial MLV core vaccine injection followed by a booster vaccination 1 year later.

Cats that have responded to vaccination with MLV core vaccines maintain a solid immunity (immunological memory) for many years in the absence of any repeat vaccination. It should be emphasized that the considerations given above do not generally apply to killed core vaccines nor to the optional vaccines, and particularly not to vaccines containing bacterial antigens. Thus *Chlamydophila* and *Bordetella* products require annual boosters for the limited protection afforded by these products.

Therefore an adult cat may today still receive an annual vaccination; however, the components of that vaccination may differ each year. Typically, core vaccines are currently administered triennially with chosen non-core products being given annually. The VGG is aware that in some countries only multi-component products containing core and non-core combinations are available. The VGG would encourage manufacturers to make a full range of vaccines available wherever possible or at the very least, make a core only combination for those not wanting to give any of the non-core vaccines.

An adult cat that received a complete course of vaccination for FPV, FHV-1 and FCV as a kitten (including the 12 month booster), but may not have been regularly vaccinated as an adult requires only a single dose of vaccine to boost immunity. It should be noted that many current data sheets will advise in this circumstance that the cat requires two vaccinations (as for a kitten) but this practice is unjustified and simply contrary to the fundamental principles of immunological memory. By contrast, this approach may be justified when an adult cat's vaccination history is unknown and where serological testing of such an animal is not performed.

Sites of Vaccination for Cats

Over the past 20 years it has become evident that one trigger for the feline injection site sarcoma (FISS) may be the administration of adjuvanted FeLV and rabies vaccines. Most subcutaneous injections (including of vaccines) have traditionally been given into the interscapular region of the cat and this is a common site for formation of a FISS. The infiltrative nature of these tumours has meant that often radical surgical resection was necessary to attempt removal of these lesions.

In North America the response to this issue was the recommendation of a protocol whereby the two perceived high-risk adjuvanted vaccines would be administered into distinct anatomical sites that would be more amenable to surgical removal of any FISS that might develop. Accordingly the recommendation 'left leg leukaemia, right leg rabies' suggested that FeLV vaccine should be given as far distal as possible into the left hind limb, whilst rabies vaccine should be given as far distal as possible into the right hind limb. A recent study has evaluated the effect of this practice by comparing the anatomical distribution of FISS in cats before the recommendation was made (1990–1996) and after the practice was adopted (1997–2006). These data show a significant decrease in the prevalence of interscapular FISS and an increase in prevalence of tumours in the right (but not left) hind limb. More notably, there was also an increase in the number of tumours reported arising in the right and left lateral abdomen, and this was attributed to the difficultly of injecting into the distal hindlimb and these abdominal sites being accidentally injected (Shaw et al., 2009).

This practice has not been adopted outside of North America. Given these recent data, the VGG recommends the following approach to reducing the risk of FISS:

- Non-adjuvanted vaccines should be administered to cats wherever possible.
- Vaccines (particularly adjuvanted products) should not be administered into the interscapular region.

- Vaccines (particularly adjuvanted products) should be administered into other subcutaneous (and not intramuscular) sites. The most accessible sites, with acceptable safety for the vaccinator (i.e. to avoid accidental self-injection during difficult restraint of the animal), would appear to be the skin of the lateral thorax or abdomen. The skin of the lateral abdomen represents the best choice as FISS that might arise at this site may be more readily excised than those occurring in the interscapular or intercostal regions where more extensive surgical resection is required.
- Vaccines should be administered into a different site on each occasion. This site should be recorded in the patient's record or on the vaccination card by use of a diagram indicating which products were administered on any one occasion. The sites should be 'rotated' on each occasion. Alternatively, a practice might develop a group policy that all feline vaccinations are administered to a specific site during one calendar year and this site is then rotated during the following year.
- The VGG encourages all cases of suspected FISS to be notified via the appropriate national reporting route for suspected adverse reactions.

Serological Testing

At this point in time there is limited availability of serological testing for vaccinal antibody responses in the cat, and tests for the detection of FPV antibody in this context are still under development. The titre check test routinely used in the USA for CPV antibody can be used to detect FPV antibody in the cat. It is not anticipated that a titre test for serum antibody to FCV nor FHV-1 will ever be of value in measuring vaccine immunity in the cat. Therefore, the VGG endorses the use of the serological tests for FPV antibody only. These test results can be used in the same way as described above for the dog. It should be emphasized that antibody testing for FIV is used to diagnose disease and is of no value in determining immunity to FIV.

Table 3 WSAVA Feline Vaccination Guidelines

Vaccine	Initial kitten vaccination (≤ 16 weeks)	Initial adult vaccination (> 16 weeks)	Revaccination recommendation	Comments
Panleukopenia Virus (FPV; MLV, parenteral) FPV (killed, adjuvanted or killed, non-adjuvanted, parenteral) FPV (MLV, non-adjuvanted, intranasal)	Begin at 8–9 weeks of age, with second dose 3–4 weeks later, and final dose at 16 weeks of age or later	2 doses, 3–4 weeks apart	A single dose is given 1 year following the last dose of the initial series, then no more frequently than every 3 years	Core. Use of MLV vaccines is not recommended in pregnant cats and FeLV and/or FIV infected cats. Intranasal vaccination may not be as effective as injectable vaccination in high-risk environments where exposure may occur soon after vaccination such as animal shelters. Parenteral MLV is recommended in shelters.
Feline Herpesvirus-1 (FHV-1; MLV, non-adjuvanted, parenteral and intranasal products are available) FHV-1 (killed, adjuvanted, parenteral)	Begin at 8–9 weeks of age, with second dose 3–4 weeks later, and final dose at 16 weeks of age or later.	2 doses, 3–4 weeks apart	A single dose is given 1 year following the last dose of the initial series, then every 3 years.	Core. MLV FHV-1/FCV vaccines are invariably combined with each other, either as bivalent products or in combination with additional vaccine antigens (e.g. FPV). Mild upper respiratory disease signs are occasionally seen following intranasal vaccination.
Feline calicivirus (FCV; MLV, non-adjuvanted, parenteral and intranasal products are available) FCV (killed, adjuvanted, parenteral)	Begin at 8–9 weeks of age, with second dose 3–4 weeks later, and final dose at 16 weeks of age or later.	2 doses, 3–4 weeks apart	A single dose is given 1 year following the last dose of the initial series, then every 3 years.	Core. MLV FHV-1/FCV vaccines are invariably combined with each other, either as bivalent products or in combination with additional vaccine antigens. Mild upper respiratory disease signs are occasionally seen following intranasal vaccination.
Rabies (canary pox virus-vectored recombinant, non-adjuvanted, parenteral)	Administer a single dose as early as 8 weeks of age, with revaccination 1 year later.	Administer 2 doses, 12 months apart.	Annual booster is required.	Non-core except where required by statute (e.g. for pet travel) or in areas where the disease is endemic
Rabies (1, 3 and 4 year killed, adjuvanted products are available, parenteral)	Administer a single dose as early as 12 weeks of age, with revaccination 1 year later.	Administer 2 doses, 12 months apart.	Booster as per licensed DOI or as required by local regulations.	Non-core except where required by statute (e.g. for pet travel) or in areas where the disease is endemic

Table 3 Continued

Vaccine	Initial kitten vaccination (≤ 16 weeks)	Initial adult vaccination (> 16 weeks)	Revaccination recommendation	Comments
Feline Leukemia Virus (FeLV; canary pox virus-vectored recombinant, non-adjuvanted, transdermal USA and injectable elsewhere)	Administer an initial dose as early as 8 weeks of age; a second dose should be administered 3–4 weeks later. Two initial doses required.	2 doses, 3–4 weeks apart	When indicated a single dose is given 1 year following the last dose of the initial series, then not more often than every 3 years in cats determined to have sustained risk of exposure.	Non-Core. In the United States, the 0.25 ml rFeLV vaccine dose may only be administered via the manufacturer's transdermal administration system. Only FeLV negative cats should be vaccinated. FeLV testing prior to vaccine administration should be mandatory.
FeLV (killed, adjuvanted, parenteral) FeLV (recombinant protein subunit, adjuvanted, parenteral)	Administer an initial dose as early as 8 weeks of age; a second dose should be administered 3–4 weeks later. Two initial doses required.	2 doses, 3–4 weeks apart	When indicated, a single dose is given 1 year following the last dose of the initial series, then not more often than every 3 years in cats determined to have sustained risk of exposure.	Non-Core. Only FeLV negative cats should be vaccinated. FeLV testing prior to vaccine administration should be mandatory.
Feline Immunodeficiency Virus (FIV; killed, adjuvanted, parenteral)	3 doses are required: The initial dose is administered as early as 8 weeks of age; 2 subsequent doses should be administered at an interval of 2–3 weeks.	3 doses are required: Each dose is administered 2 –3 weeks apart.	When indicated, a single dose is given 1 year following the last dose of the initial series, then annually in cats determined to have sustained risk of exposure.	Not recommended. Vaccination induces production of antibodies indistinguishable from those developed in response to FIV infection, and interferes with antibody-based FIV diagnostic tests for at least a year following vaccination. Some discriminatory serological tests have been reported and quantitative PCR diagnostics are becoming more widely available.
Feline Infectious Peritonitis (FIP; MLV, non-adjuvanted, intranasal)	Administer a single dose as early as 16 weeks of age, and a second dose 3–4 weeks later.	2 doses, 3–4 weeks apart.	Annual booster is recommended by the manufacturer.	Not Recommended. According to the limited studies available, only cats known to be feline coronavirus antibody negative at the time of vaccination are likely to develop some level of protection. It is rare that a cat will be coronavirus antibody negative.
Chlamydophila felis (avirulent live, non-adjuvanted, parenteral) *Chlamydophila felis* (killed, adjuvanted, parenteral)	Administer the initial dose as early as 9 weeks of age; a second dose is administered 3–4 weeks later.	Administer 2 doses, 3–4 weeks apart.	Annual booster is indicated for cats with sustained exposure risk.	Non-Core. Vaccination is most appropriately used as part of a control regime for cats in multiple-cats environments where infections associated with clinical disease have been confirmed. Inadvertent conjunctival inoculation of vaccine has been reported to cause clinical signs of infection. These vaccines may be associated with adverse reactions (hypersensitivity).
Bordetella bronchiseptica (avirulent live, non-adjuvanted, intranasal)	Administer a single dose intranasally as early as 8 weeks of age.	Administer a single dose intranasally	Annual booster is indicated for cats with sustained risk.	Non-Core. Vaccination may be considered in cases where cats are likely to be at specific risk of infection. Studies have not shown this product to reduce severity of the feline respiratory disease complex.

The killed parenteral *Giardia lamblia* vaccine for the cat (listed in the 2007 guidelines) is now no longer available.

Table 4 WSAVA Guidelines on Feline Vaccination for the Shelter Environment

Vaccine	Kittens (≤ 16 weeks)	Adult and Adolescent (> 16 weeks)	Comments
FPV FHV-1 FCV	Administer a single dose prior to or *at the time of admission* as early as 4–6 weeks of age; then, every 2–4 weeks until 16 weeks of age if still in the facility. The earlier recommended age (4 weeks) and short end of the interval (2 weeks) should be used in very high risk environments or during outbreaks.	Administer a single dose *at the time of admission*; repeat in 2–4 weeks if the animal remains in the shelter.	MLV preparations are preferable. Use of intranasal FPV vaccines is generally not recommended in the shelter environment. Use of intranasal FCV/FHV-1 MLV vaccines may be preferable when rapid onset (48 hrs) of immunity is important. Post-vaccinal sneezing, more commonly seen following administration of intranasal FCV/FHV-1 vaccine, may be impossible to distinguish from active infection.
Rabies	If at all, a single dose should be administered *at the time of discharge* from the facility.	If at all, a single dose should be administered *at the time of discharge* from the facility.	The administration of rabies vaccine will be determined by whether the shelter is in a country in which the disease is endemic, and by local statute.

The VGG does not recommend the use of other feline vaccines in the shelter situation.

VACCINATION IN THE SHELTER ENVIRONMENT

An animal shelter is a holding facility for animals usually awaiting adoption, rescue, or reclaim by owners. In general, animal shelters are characterized by a random source population with a mostly unknown vaccination history, high population turnover, and high infectious disease risk. The term 'shelter' encompasses situations ranging from sanctuaries that possess a stable population, to facilities that admit hundreds of animals per day, to rescue and foster homes that care for multiple individuals or litters at any given time. Just as the vaccination strategy varies with each individual pet, there is no one-size-fits-all strategy for vaccinating shelter animals. The likelihood of exposure and the potentially devastating consequences of infection necessitate a clearly defined shelter vaccination program.

Shelter medicine differs from individual care in that it has to practice in an environment where eradication of infectious disease cannot be attained. It is possible, however, to minimize the spread of infections within a high-density, high-risk population and maintain the health of not yet infected individuals. When the overall purpose is to place healthy pets into welcoming homes, the time and effort dedicated to controlling infectious disease is only one of many variables in the complex shelter medicine and husbandry equation. The recommendations provided here attempt to address some shelter-unique issues as they pertain to vaccination and disease control.

Guidelines and recommendations for vaccines to be used in shelters are given in Tables 2 and 4. If unambiguous documentation of vaccination is provided for an animal at the time of admission to a shelter, there is no reason to revaccinate with canine core vaccines, but feline core vaccines, specifically the FCV and FHV, may be of value in boosting immunity.

The VGG discriminates between a shelter and a boarding kennel/cattery. The later are facilities where fully vaccinated animals may be temporarily boarded for relatively short periods of time (e.g. when owners are on vacation). It should be a requirement of entry to any such facility that the individual dog or cat is fully vaccinated with core products given according to the guidelines presented herein. The use of non-core vaccines against respiratory infections is also appropriate under these circumstances. The VGG is aware that in some countries vaccination protocols for animals entering a boarding kennel/cattery are formulated by local authorities and may be contrary to current guidelines (e.g. insistence on annual revaccination). The VGG encourages such authorities to reconsider these recommendations in light of current scientific thinking.

GENERAL CONSIDERATIONS

Comprehensive Individual Care beyond Vaccination

In the past, veterinary practice has benefited from the annual administration of vaccines. By encouraging owners to bring their pets yearly for vaccination, veterinarians were able to recognize and treat disease earlier than might otherwise have been the case. In addition, the annual visit provided an opportunity to inform clients of important aspects of canine and feline health care.

Unfortunately, many clients have come to believe that vaccination is the most important reason for annual veterinary visits. Veterinarians are now concerned that a reduction in vaccination frequency will cause clients to forgo the annual visits and that the quality of care will diminish. It is therefore essential that veterinarians stress the importance of all aspects of a comprehensive individualized health care program. Emphasis should be placed on a detailed vaccination interview, a comprehensive physical examination by the veterinarian, and individualized patient care. The importance of dental care, proper nutrition, appropriate diagnostic testing and the control of parasites and of zoonotic diseases should also be addressed during evaluation of each pet. Behaviour concerns should be discussed, as well as the necessity for more frequent examination of young and geriatric animals.

The yearly health care/vaccination interview should assess the need for non-core vaccines for the pet. The practitioner should explain to the client the types of vaccines available, their potential benefits and risks, and their applicability to the particular animal, given its lifestyle and risk of exposure. Whilst an animal might not receive core vaccination every year, most non-core vaccines do require annual administration – so owners will continue to see their animal vaccinated annually. The regional incidence and risk factors for various infectious diseases should also be discussed. Ways to reduce the impact of acquired disease (e.g., avoiding overcrowding, improving nutrition, and restricting access to infected animals) should also be reviewed.

Vaccinations should be considered as only one component of a comprehensive preventive health care plan individualized based on the age, breed, health status, environment (potential exposure to harmful agents), lifestyle (contact with other animals), and travel habits of the pet.

Age has a significant effect on the preventive health care needs of any given individual. Puppy/kitten programs have traditionally focused on vaccinations, parasite control, and neutering. Today, opportunity exists to incorporate behaviour counselling and zoonotic disease management. For the aging pet, senior care programs are becoming increasingly popular. Nutritional, dental disease, and parasite control assessment and counselling should take place on an individualized basis throughout the life of the pet. There is no evidence that older dogs and cats, which have been fully vaccinated as pups or kittens, require a specialized programme of core vaccination. Experimental evidence shows that aged dogs and cats have persisting immunological memory to core vaccines that is readily boosted by administration of a single vaccine dose. By contrast, aged animals may not be as efficient at mounting primary immune responses to novel antigens that they have not previously encountered. Studies of UK dogs and cats vaccinated for the first time against rabies for pet travel have clearly shown that more aged animals fail to achieve the legally required antibody titre.

Certain breeds are predisposed to various diseases. Early detection (particularly of neoplasia) and management of breed-associated disease can significantly improve the quality of the animal's entire life. Pets with chronic medical conditions warrant periodic scheduled medical progress examinations and testing. Animals receiving certain medications also warrant therapeutic monitoring of blood levels and/or organ systems. The development of recheck protocols for chronic diseases and medications, which can be included in reminder systems, can greatly improve client compliance and, accordingly, pet care.

The environment in which a pet resides can profoundly affect its health status and should be assessed during annual health care visits in order to define risk factors and develop appropriate preventive measures.

By determining the extent to which dogs and cats come into contact with other animals in unobserved circumstances, veterinarians can assess the need for non-core vaccinations. Dogs that visit kennels, grooming salons, common areas, and wooded, tick-infested areas are potentially at greater risk from certain infectious diseases than dogs that do not frequent these areas.

Just as the human population has become more mobile, so has the pet population, resulting in potential exposure to infectious agents, parasites, and environmental hazards not found in the home environment. Determining past and anticipated future travel during each visit allows for greater individualization of preventive care and diagnostic testing plans.

Medical Record Documentation

At the time of vaccine administration, the following information should be recorded in the patient's permanent medical record:

- date of vaccine administration,
- identity (name, initials, or code) of the person administering the vaccine,
- vaccine name, lot or serial number, expiry date, and manufacturer
- site and route of vaccine administration.

The use of peel-off vaccine labels and stamps that imprint the medical record with the outline of a pet facilitates this type of record keeping which is mandatory in some countries. Adverse events should be recorded in a manner that will alert all staff members during future visits. Informed consent should be documented in the medical record in order to demonstrate that relevant information was provided to the client and that the client authorized the procedure (e.g. 'off-label' use of products as discussed above). At the very least, this notation should indicate that a discussion of risks and benefits took place prior to vaccination.

Adverse Events

Adverse events are defined as any side effects or unintended consequences (including lack of protection) associated with the administration of a vaccine product. They include any injury, toxicity, or hypersensitivity reaction associated with vaccination, *whether or not the event can be directly attributed to the vaccine*. Adverse events should be reported, whether their association with vaccination is recognized or only suspected. A vaccine adverse event report should identify the product(s) and animal(s) involved in the event(s) and the individual submitting the report.

Reporting field observations of unexpected vaccine performance is the most important means by which the manufacturer and the regulatory agency are alerted to potential vaccine safety or efficacy problems that may warrant further investigation. The purpose of pre-licensure safety studies is to detect relatively common adverse events. Rare adverse events will be detected only by post-marketing surveillance through analysis of reported adverse events. Adverse events should be reported to the manufacturer and/or the local regulatory authority. In many countries governmental surveillance schemes are not available and reactions should therefore be notified to the manufacturer. The VGG recognizes that there is gross under-reporting of vaccine-associated adverse events which impedes knowledge of the ongoing safety of these products. The VGG would actively encourage all veterinarians to participate in such surveillance schemes.

If a particular adverse event is well documented, reporting serves to provide a baseline against which future reports can be compared. In addition, reported adverse events can lead to detection of previously unrecognized reactions, detection of increases in known reactions, recognition of risk factors associated with reactions, identification of vaccine lots with unusual events or higher numbers of adverse events, and can further stimulate clinical, epidemiological, or laboratory studies. Therefore, veterinarians are encouraged to report any clinically significant adverse event occurring during or after administration of any licensed vaccine. Reporting a vaccine adverse event is not an indictment against a particular vaccine; it facilitates review of temporally associated conditions and adds to the safety database of the product.

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This document, including the following online only appendices, is available with the online June issue of *JSAP*

Appendix I: Canine and Feline Infectious Disease Fact Sheets
Appendix II: Frequently Asked Questions
Appendix III: Image Bank for Major Canine and Feline Infectious Diseases

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