

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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CONTENTS

Executive Summary	2
Introduction	2
Current Issues in Small Animal Vaccinology	3
Canine Vaccination Guidelines.....	3
Feline Vaccination Guidelines.....	6
Vaccination in the Shelter Environment.....	6
General Considerations	7
Tables 1 to 4.....	9



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 VGG acknowledges the valuable foundation to their deliberations provided by the recent canine and feline vaccine guidelines from the United States of America (USA). The VGG recognises 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 minimises the likelihood of outbreak of infectious disease.

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 which have global distribution. Core vaccines for dogs are those that protect from canine distemper virus (CDV), canine adenovirus (CAV) and canine parvovirus (CPV). Core vaccines for cats are those that protect from feline parvovirus (FPV), feline calicivirus (FCV) and feline herpesvirus (FHV). 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 recognises 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 between litters, the VGG recommends the administration of three vaccine doses to pups and kittens, with the final of these being delivered at 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 sero-conversion (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.

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 are generally administered annually.

The VGG has considered the use of vaccines in the shelter environment, again recognising 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 vaccine only. Where finances permit, repeated core vaccination should be administered as per the schedules defined in the guidelines.

The VGG recognises 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 single strap-line:

We should aim to vaccinate every animal, and to vaccinate each individual less frequently

INTRODUCTION

One of the greatest successes of modern veterinary science has been the control of infectious disease through the development and implementation of vaccination programmes. This success is typified by the rapid decline in the prevalence of key canine infectious diseases (caused by canine distemper virus [CDV], canine adenovirus [CAV] and canine parvovirus [CPV]) following the introduction of efficacious modified live virus vaccines. Similar effects relate to the introduction of feline vaccines, with clear reduction in mortality caused by feline parvovirus (FPV; feline panleukopenia) and morbidity caused by feline calicivirus (FCV) and herpesvirus (FHV) infections. However, the success of these vaccines cannot be a cause for complacency, and indeed vaccine-related issues have featured high on the agenda of the veterinary profession over the past decade. There are many challenges remaining in small animal vaccinology, and in 2006 the WSAVA Vaccination Guidelines Group (VGG) was convened with the specific remit of taking a global

perspective on issues surrounding the practice of vaccination of dogs and cats. The VGG has met formally on three occasions and corresponded electronically between these meetings, and this document is the result of these deliberations. The VGG guidelines are built on those developed by the American Animal Hospital Association (AAHA) Canine Vaccine Task Force and the American Association of Feline Practitioners (AAFP) Feline Vaccine Advisory Panel. Based upon a consensus among experts, these recommendations reflect a combination of opinion, experience, and scientific data, published and unpublished. The present vaccination guidelines are intended for the general veterinary practice and the shelter environment; they do not represent a standard of care or set of legal parameters. They have been drafted with the objective of educating and informing the profession and to recommend rational vaccine use for individual pets and dog/cat populations.

CURRENT ISSUES IN SMALL ANIMAL VACCINOLOGY

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.

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 minimise 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 categorisation 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 categorisation of vaccines has been the push towards marketing products with extended duration of immunity (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 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 emphasise 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 recognises 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 single strap-line:

We should aim to vaccinate every animal, and to vaccinate each individual less frequently

CANINE VACCINATION GUIDELINES

VACCINATION OF INDIVIDUAL DOGS

The Basic Immunisation 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 recognises 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 maternally derived antibodies (MDA) in the first weeks of life. In general, passive immunity will have waned by 8 to 12 weeks of age to a level that allows active immunisation. 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 to 9 weeks of age followed by a second vaccination 3 to 4 weeks later, and a third vaccination given between 14 to 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 socialisation' of pups. The VGG recognises 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.

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 neutralising 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.

All dogs should receive a first booster 12 months after completion of the primary vaccination course. The VGG redefines the basic immunisation 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 vaccination course.

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 three years or longer, unless special conditions apply. It should be emphasised 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 require more frequent boosters for reliable protection.

Serological Testing to Monitor Immunity to Canine Vaccines

Antibody tests are useful for monitoring immunity to CDV, canine parvovirus-2 (CPV-2), canine adenovirus-1 (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 standardised 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 to 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.

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

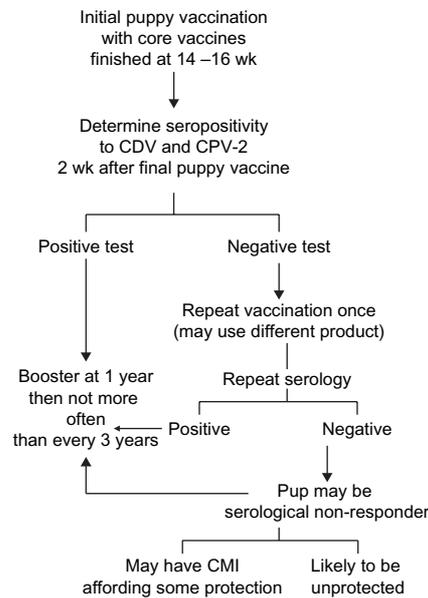


FIG 1. Flow chart for serological testing of puppies. CMI, Cell-mediated immunity

(1) MDA neutralises the vaccine virus

This is the most common reason for vaccination failure. When the last vaccine dose is given at ≥ 12 weeks of age however, MDA should have decreased to a low level, and active immunisation 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 recognise 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 recognised 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 than other breeds, possibly because carriers of the genetic trait may have died from CPV-2. This may not be true for other countries. For example, in the UK and Germany, the non-responder phenotype remains prevalent amongst Rottweilers.

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 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. canine parainfluenza). Important considerations in performing antibody tests are the cost and the time to obtain results.

The VGG recognises 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 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.

FELINE VACCINATION GUIDELINES

VACCINATION OF INDIVIDUAL CATS

The Basic Immunisation Schedule

Guidelines and recommendations for core (recommended), non-core (optional) and not generally 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 realise that the protection afforded by the feline calicivirus (FCV) and feline herpesvirus (FHV) vaccines will not provide the same efficacy of immunity as seen with the feline panleukopenia (feline parvovirus; 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, it should be remembered that there is no herpesvirus vaccine than 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.

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 to 12 weeks of age to a level that allows an active immunological response, and an initial vaccination at 8 to 9 weeks of age followed by a second vaccination 3 to 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 endorses the recent recommendation made in the AAEP guidelines of administering the final kitten dose at 16 weeks or older.

All kittens should receive the core vaccines. A minimum of three doses – one at 8 to 9 weeks of age, a second 3 to 4 weeks later and a final dose at 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 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 three 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 one 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 emphasised 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 *Chlamydomphila* and *Bordetella* products require more frequent boosters for reliable protection.

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. Once these are available, the VGG would endorse their use in the same way as described above for the dog.

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 characterised 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 minimise 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.

The VGG discriminates between a shelter and a boarding kennel/cattery. The latter 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.

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 recognise 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 individualised health care program. Emphasis should be placed on a detailed vaccination interview, a comprehensive physical examination by the veterinarian, and individualised 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 preventative health care plan individualised 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 preventative 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 individualised basis throughout the life of the pet.

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 preventative 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 individualisation of preventative 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 authorised the procedure. 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 recognised 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. The VGG recognises 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 unrecognised 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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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 (CPV-2) (MLV)	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
Canine Distemper Virus (CDV) (MLV)				
Recombinant Canine Distemper Virus (rCDV)				
Canine Adenovirus-2 (CAV-2) (MLV parenteral)				
Canine Parvovirus (CPV-2) (killed)				Not recommended where MLV available
Canine Adenovirus-1 (CAV-1) (MLV and killed)				Not Recommended where CAV-2 MLV available
Canine Adenovirus-2 (CAV-2) (killed or MLV-topical)				
Rabies (killed)	Administer one dose as early as 3 months of age	Administer a single dose	Canine rabies vaccines with either a 1- or 3-year duration of immunity are available. Timing of boosters is determined by this licensed DOI but in some areas may be dictated by statute	Core where required by statute 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 not more often than every 3 years	Non-core. Use of CPiV (MLV-intranasal) is preferred to the parenteral product as the primary site of infection is the upper respiratory tract
Parainfluenza Virus (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 not more often than every 3 years	Non-core. This product is generally combined with intranasal <i>Bordetella bronchiseptica</i> and this product should be administered annually following the puppy series
<i>Bordetella bronchiseptica</i> (live avirulent bacteria)	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
<i>Bordetella bronchiseptica</i> (killed bacterin)-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
<i>Bordetella bronchiseptica</i> (cell wall antigen extract)-parenteral				

(continued)

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
<i>Borrelia burgdorferi</i> (Lyme borreliosis) (killed whole bacterin) <i>Borrelia burgdorferi</i> (Lyme borreliosis) (recombinant-Outer surface protein A [OspA])	Recommendation is for initial dose at 9 or 12 weeks of age 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
<i>Leptospira interrogans</i> (combined with serovars canicola and icterohaemorrhagiae) (killed bacterin) (Also available in the USA with serovars grippityphosa and pomona)				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 risk. These dogs should be vaccinated at 12 to 16 weeks of age, with a second dose 3-4 weeks later, and then at intervals of 6-9 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. 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 high risk of exposure
Canine Coronavirus (CCV) (killed and MLV)				Not Recommended. Prevalence of clinical cases of confirmed CCV disease does not justify vaccination
<i>Giardia lamblia</i> (killed)				Not Recommended. There is insufficient data to warrant routine use of this vaccine

The VGG did not consider the following products:

- *Crotalus atrox* Toxoid (rattlesnake vaccine)
- *Porphyromonas* sp. (periodontal disease vaccine)
- *Leishmania* vaccine (fucose mannose ligand of *L. donovani* in saponin)
- *Babesia* vaccine (soluble parasite antigen from *B. canis* in saponin)
- *Babesia* vaccine (soluble parasite antigen from *B. canis canis* and *B. canis rossii* in saponin)
- *Melanoma* vaccine (Human tyrosinase gene in bacterial plasmid)

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
Canine Distemper Virus + Canine Adenovirus-2 + Canine Parvovirus (MLV) with or without Canine Parainfluenza rCanine Distemper Virus + Canine Adenovirus-2 + Canine Parvovirus (rCDV + MLV) with or without Canine Parainfluenza	Administer one dose on admission. Repeat at 2-week intervals until 16 weeks of age if animal is still in the facility	Administer one dose 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 2-3 weeks (for distemper) or 5 weeks (for parvovirus) may be indicated
Combination product is administered SQ or IM according to manufacturer's recommendations.	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		MDA, if present, can interfere with immunisation
<i>Bordetella bronchiseptica</i> (avirulent live bacterin) + Parainfluenza Virus (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
<i>Bordetella bronchiseptica</i> (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
Rabies	If at all, a single dose should be administered <i>at the time of discharge</i> from the facility	If at all, a single dose should be administered <i>at the time of discharge</i> 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

Table 3. WSAVA Feline Vaccination Guidelines

Vaccine	Initial kitten vaccination (≤ 16 weeks)	Initial adult vaccination (> 16 weeks)	Revaccination recommendation	Comments
Panleukopenia Virus (FPV) (MLV, non-adjuvanted) Panleukopenia Virus (FPV) (Killed, adjuvanted; Killed, non-adjuvanted) Panleukopenia Virus (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 to 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. Killed vaccines may be more appropriate in disease-free colonies as there is no risk of spread or reversion to virulence. Intranasal vaccination may not be as effective as injectable vaccination in high-risk environments where exposure may occur soon after vaccination
Feline Herpesvirus-1 (FHV-1) (MLV, non-adjuvanted) Feline Herpesvirus-1 (FHV-1) (Killed, adjuvanted)	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 to 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. Upper respiratory disease signs are more commonly seen following intranasal vaccination
Feline calicivirus (FCV) (MLV, non-adjuvanted) Feline calicivirus (FCV) (Killed, adjuvanted)	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 to 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. Upper respiratory disease signs are more commonly seen following intranasal vaccination
Rabies (Canarypox virus-vectored recombinant, non-adjuvanted)	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)	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	Non-core except where required by statute (e.g. for pet travel) or in areas where the disease is endemic
Feline Leukemia Virus (FeLV) (Canarypox 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	2 doses, 3 to 4 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	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

(continued)

Table 3. (continued)

Vaccine	Initial kitten vaccination (≤ 16 weeks)	Initial adult vaccination (> 16 weeks)	Revaccination recommendation	Comments
Feline Leukemia Virus (FeLV) (Killed, adjuvanted) Feline Leukemia Virus (FeLV) (recombinant protein subunit, adjuvanted)	Administer an initial dose as early as 8 weeks of age; a second dose should be administered 3-4 weeks later	2 doses, 3 to 4 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	Non-core. Only FeLV negative cats should be vaccinated. FeLV testing prior to vaccine administration should be mandatory
Feline Immunodeficiency Virus (FIV) (Killed, adjuvanted)	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 all antibody-based FIV diagnostic tests for at least a year following vaccination
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
<i>Chlamydomydia felis</i> (Avirulent live, non-adjuvanted) <i>Chlamydomydia felis</i> (Killed, adjuvanted)	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)
<i>Bordetella bronchiseptica</i> (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
Feline <i>Giardia</i> (Killed, adjuvanted)	Administer a single dose at 8 weeks of age; a second dose is administered 2-4 weeks later	2 doses, 2-4 weeks apart	Annual booster is recommended by the manufacturer	Not Recommended. There are insufficient studies available to support the role of <i>Giardia</i> vaccination in preventing clinical signs of disease in cats

Table 4. WSAVA Guidelines on Feline Vaccination for the Shelter Environment

Vaccine	Kittens (\leq 16 weeks)	Adult and Adolescent ($>$ 16 weeks)	Comments
Panleukopenia Virus (FPV) Feline Herpesvirus-1 (FHV-1) Feline Calicivirus (FCV)	Administer a single dose <i>at the time of admission</i> as early as 4 to 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 <i>at the time of admission</i> ; repeat in 2-4 weeks	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 <i>at the time of discharge</i> from the facility	If at all, a single dose should be administered <i>at the time of discharge</i> 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

APPENDICES

FACT SHEET: CANINE PARVOVIRUS TYPE 2 (CPV-2) VACCINES

Types of Vaccines Available:

1. **Modified Live Virus (MLV) Vaccines:** These vaccines contain canine parvovirus of various isolates, different genotypes and at various titres. Currently, four genotypes are recognised world-wide, which are referred to as CPV-2 (the original genotype), CPV-2a, CPV-2b, CPV-2c. All genotypes are antigenically comparable - vaccination with any one will provide protective immunity against all the other genotypes.
2. **Inactivated (Killed) Vaccines:** Only a few killed CPV-2 vaccines are available; they are less effective and take much longer to induce an immune response when compared to the MLV vaccines. They are not recommended for routine use. Killed vaccines may provide some benefit in wild and exotic species or pregnant bitches, where MLV vaccines are not recommended. However, killed CPV-2 vaccines have not been tested for safety or efficacy in these situations.

Mechanisms and Duration of Immunity (DOI):

1. DOI after natural infection/disease is lifelong.
2. DOI after vaccination with MLV vaccines is 7 years or longer, based on challenge and serological studies.
3. DOI after vaccination with killed vaccines is unknown; a killed feline parvovirus (panleukopenia) vaccine was demonstrated to provide a DOI of 7.5 years in the cat.
4. Systemic immunity from vaccination with MLV products is mediated by IgG and IgM neutralising antibodies. An antibody titre correlated with protective immunity is stimulated only after multiple doses of the parenterally administered, killed, non adjuvanted vaccines. Secretory IgA and CMI are not important for protective immunity.
5. Maternally derived antibody (MDA) interferes with active immunisation for varying periods of time in the puppy, depending on the titre of colostral antibody and the amount of antibody absorbed after birth.
6. The “window of susceptibility” is defined as the period of time (10 to 12 weeks), during which a pup can be infected by field virus, while vaccines of low viral titre and/or low immunogenicity do not immunise. The MDA will not prevent infection/disease for as long as 12 weeks until such vaccines can immunise. By contrast, for highly effective MLV vaccines the “window of susceptibility” is as short as two weeks.
7. After completing the puppy series at around 16 weeks and vaccinating again at 1 year of age, revaccination need not be done more often than every 3 years.
8. In the absence of MDA, MLV vaccines provide immunity as early as 3 days after vaccination.
9. The presence of serum antibody, regardless of titre, in an actively immunised dog over the age of 16 weeks is correlated with protection.

Precautions:

1. In geographical areas or isolation facilities where CPV-2 is not endemic in domestic or wild susceptible species, MLV vaccines should not be used as the virus will be shed and could potentially revert to virulence as well as infect other individuals or other species.
2. The attenuated vaccinal CPV-2 is always shed, but it will not cause disease in in-contact pups over 4 weeks of age, and it may immunise them. However, it may cause problems, e.g. myocarditis, in very young (less than 2 weeks of age), antibody negative pups, or infections/disease signs in exotic or wild species. MLV is shed at low levels in faeces for several days after vaccination.
3. Reversion to virulence of MLV vaccines and confirmed cases of disease caused by vaccine virus has not been reported.
4. Puppies younger than 5 weeks should not be vaccinated with MLV products.
5. If a dog is found positive in a CPV-2 antigen test, especially if it has signs of parvovirus, regardless of recent (<2 weeks) vaccination, the animal should be considered infected with virulent CPV-2. Vaccinated dogs usually do not shed enough virus to cause the test to become positive.

Incubation Period:

After infection, it takes 5 days or longer for signs of disease to appear. CPV-2 faecal shedding rarely persists for >2 weeks. Dogs persistently infected for >4 weeks have not been reported and one can expect the animal to die or clear the virus in that period of time. In the environment, however, the virus can remain infectious for one year or more. Therefore, all facilities where infected animals have been present must be considered infected.

FACT SHEET: CANINE ADENOVIRUS (CAV-2) VACCINES

Types of Vaccines Available:

1. **Modified Live Virus (MLV) Vaccines:** CAV-2 containing vaccines are the most commonly available products. They are the only vaccines recommended for the prevention of infectious canine hepatitis (ICH) caused by CAV-1 and for reducing the signs of respiratory disease associated with CAV-2 infection. They are exceptionally effective and will not cause the adverse reaction commonly seen with CAV-1 vaccines known as allergic uveitis or “blue eye.” In addition to parenteral MLV vaccine preparations there are combination products to protect against the canine respiratory disease complex (CRDC), which include *Bordetella bronchiseptica* and canine parainfluenza virus. This intranasal product can be used to decrease the severity of CRDC, but should not be used as the only vaccine to prevent ICH; for this purpose, the parenteral MLV-CAV-2 should also be given.
2. **Inactivated (Killed) Vaccines:** Inactivated (killed) CAV-1 and CAV-2 vaccines are available in some countries but they are not recommended as they are poorly effective and can cause adverse reactions.

Mechanisms and Duration of Immunity (DOI):

1. DOI after natural CAV-1 infection and ICH disease is lifelong.
2. DOI after vaccination with MLV vaccines is 7 years or longer, based on challenge and serological studies.
3. DOI for protection from ICH with killed CAV-1 or CAV-2 is unknown. The DOI for protection from CRDC caused by CAV-2 in combination with other agents is approximately 3 years, but as a multifactorial disease CRDC is not vaccine-preventable. The current vaccines only help in reducing disease severity. Other factors, like stress, poor ventilation, dust, ammonia gas in unsanitary facilities, infections with *Streptococcus spp.*, *Pasteurella multocida*, *Bordetella bronchiseptica*, *Mycoplasma spp.*, canine parainfluenza virus and canine coronavirus contribute to CRDC.
4. Systemic immunity from vaccination is mediated by IgG virus neutralising antibody. Immunity against the CAV-2 associated with CRDC is mediated by both IgG and secretory IgA when an intranasal vaccine has been given. IgG antibody developing after a parenteral vaccination protects the lungs against infection/disease, but not against upper respiratory tract infection, which requires secretory IgA and local cell-mediated immunity. CAV-2 vaccine will not provide adequate protection against ICH if the animal had only received an intranasal vaccine.
5. Maternally derived antibody (MDA) will block immunisation after vaccination with the parenteral product, but not protection offered by the intranasal product. Since protection against ICH is afforded primarily by parenteral products, the last dose should be given along with the other viral vaccines (e.g. CDV, CPV-2) when the puppy is about 16 weeks of age.
6. After completing the puppy series at around 16 weeks and vaccinating again at 1 year of age, revaccination need not be done more often than every 3 years.
7. In the absence of MDA, MLV vaccines protect against ICH as early as 5 days after vaccination.
8. The presence of serum antibody, regardless of titre, in an actively immunised dog over the age of 16 weeks is correlated with protection.

Precautions:

1. When given intranasally, CAV-2 is readily shed from the respiratory tract, whereas it is not when given parenterally.
2. The vaccine virus has not been shown to revert to virulence in back passage studies.
3. Similar to other adenoviruses, MLV-CAV-1 and MLV-CAV-2 can cause neoplastic transformation of various cell types (such as hamster kidney cells) *in vitro*. The significance of this observation for dogs is not known.
4. CAV-2 virus is commonly present in the upper respiratory tract of dogs; thus natural immunisation, especially among show and kennel dogs is widespread.

Incubation Period:

After experimental infection with CAV-1, it takes 5 days or longer for signs of ICH to appear. CAV-2 combined with other agents associated with CRDC can cause respiratory disease in 3 to 4 days.

CAV-2 is transmitted primarily through the air, whereas CAV-1 is transmitted primarily through contaminated secretions/excretions such as saliva and urine. CAV-1 and CAV-2 are moderately stable, surviving for several days to weeks in the environment.

FACT SHEET: CANINE DISTEMPER VIRUS (CDV) VACCINES

Types of Vaccines Available:

1. **Modified Live Virus (MLV) Vaccines:** These are the most common products. They generally contain the CDV strains Rockborn, Snyder Hill, Onderstepoort, Lederle, or others at various titres. There are many biotypes of CDV which can cause varying clinical signs in a wide variety of species. However, serological differences among the many isolates are insignificant, and vaccination with any one of the current vaccines should provide protective immunity against any biotype.
2. **Vectored recombinant (rCDV) Vaccines:** A poxvirus recombinant product is available in the USA and a few other countries. It is highly effective and safer than MLV vaccines. It is therefore often used in wild and exotic species that are susceptible to CDV infection and disease. It can also be more safely used in younger animals than the MLV and it is more effective at immunising pups with maternally derived antibody (MDA).
3. **Inactivated (Killed) Vaccines:** Killed vaccines, not readily available, are not effective and therefore should not be used for immunisation against distemper.

Mechanisms and Duration of Immunity (DOI):

1. DOI after natural infection/disease is lifelong.
2. DOI after vaccination with MLV vaccines is 7 years or longer, based on challenge and serological studies.
3. DOI after vaccination with rCDV vaccine is ≥ 3 years, based on challenge and ≥ 4 years based on serology.
4. DOI after vaccination with killed vaccines is unknown.
5. Systemic immunity is predominantly mediated by neutralising antibody that prevents infection, or antibody and CMI in the vaccinated animal. Humoral immunity is provided by IgG; secretory antibody plays little or no role in preventing infection in a vaccinated animal.
6. Maternally derived antibody (MDA) interferes with active immunisation for varying periods of time in the puppy, depending on the titre of colostral antibody and the amount of antibody absorbed after birth.
7. The “window of susceptibility” is defined as the period of time, during which a pup can be infected by field virus, while vaccines of low viral titre and/or low immunogenicity do not immunise. Unlike CPV-2 vaccines, there generally is not a long “window of susceptibility” for CDV vaccines (less than 2 weeks). The rCDV vaccine is more effective in immunising in the presence of MDA than the MLV vaccines; thus, it is possible to immunise puppies at an earlier age with the rCDV vaccine than MLV.
8. Puppy vaccination using MLV products should not start earlier than 4 weeks of age; after completing the series at around 16 weeks and vaccinating again at 1 year of age, revaccination need not be done more often than every 3 years. The last dose of rCDV can be given at 12 weeks.
9. In the absence of MDA, MLV and recombinant vaccines provide immunity immediately after vaccination.
10. CDV vaccines are among the most effective vaccines when compared to vaccines for any other species. Actively immunised dogs will not develop disease regardless of the amount of virus they are exposed to by contact infection.
11. The presence of serum antibody, regardless of titre, in an actively immunised dog over the age of 16 weeks is correlated with protection.

Precautions:

1. In geographical areas or isolation facilities where CDV is not endemic in domestic or wild susceptible species, MLV vaccines should not be used. The risk of introducing a virus into a host population is unacceptable. In this situation recombinant preparations are preferred because of their safety and effectiveness.
2. Certain MLV CDV vaccines (e.g. based on the Rockborn or Snyder Hill strains) can regain virulence after about 7 experimental back passages in dogs. Since vaccinated dogs minimally shed virus, natural back passage rarely occurs. Susceptible wild carnivore species do shed the virus.
3. The MLV preparations are attenuated (modified) for use in the domestic dog, not for use in wild and exotic species. These vaccines are highly virulent (e.g. in the ferret, black-footed ferret and grey fox), causing disease and death. Vaccination of these species with MLV vaccines should never be considered.
4. Puppies younger than 4 weeks should not be vaccinated with MLV vaccines. For such young pups and for wild or exotic susceptible species, rCDV vectored vaccines are recommended. When locally unavailable, one should make every attempt to obtain rCDV vaccines rather than use an MLV product. Preparations containing the Onderstepoort strain are considered the safest, but even this MLV strain has created problems in certain species.

Incubation Period:

Signs of disease appear between 2 and 6 weeks after infection. During the incubation period, CDV causes immunosuppression, making the animal more susceptible to microbial infections. These may lead to respiratory disease, pneumonia and death, before the more typical signs of distemper virus infection appear. In the environment, the virus quickly loses infectivity.

FACT SHEET: FELINE PANLEUKOPENIA VIRUS (FPV) VACCINES

Types of Vaccines Available:

1. **Modified Live Virus (MLV) Vaccines:** These preparations contain attenuated (avirulent) feline parvovirus (feline panleukopenia virus) at various titres, without adjuvant. There are injectable preparations and others for intranasal application, alone or in combination with other vaccinal antigens. MLV vaccines are advantageous for their faster onset of action, greater efficacy at overcoming maternal antibody, and greater likelihood of conferring sufficient immunity.
2. **Inactivated (Killed) Vaccines:** Killed adjuvanted FPV vaccines are available; a single injected dose may induce good antibody responses in naïve cats within a relatively short time span. Killed vaccines may be beneficial in wild and exotic species or pregnant queens, where MLV vaccines are not recommended.

Mechanisms and Duration of Immunity (DOI):

1. DOI after natural infection/disease is lifelong.
2. DOI after vaccination with MLV vaccines is 7 years or longer, based on challenge and serological studies.
3. DOI after vaccination with a killed panleukopenia vaccine was demonstrated to last for 7.5 years.
4. While most cases of feline panleukopenia are caused by infection with FPV, variants of canine parvovirus (CPV-2a, CPV-2b, and CPV-2c) have emerged that infect cats and may cause disease. Current FPV vaccines afford protection against these CPV variants.
5. Systemic immunity from vaccination is mediated by neutralising antibodies. Antibody titre correlates with protection. Secretory IgA and CMI are not important for protective immunity.
6. Maternally derived antibody (MDA) interferes with active immunisation for varying periods of time in the kitten, depending on the titre of colostral antibody and the amount of antibody absorbed during the first 8 hours after birth.
7. The “window of susceptibility” is defined as the period of time, during which a kitten can be infected by field virus, while vaccines of low viral titre and/or low immunogenicity do not immunise. By analogy with canine parvovirus, an immunity gap is assumed to exist at around 6 to 8 weeks of age, when antibody levels are too low to protect against natural infection, but still high enough to interfere with vaccination.
8. After completing the kitten series at around 16 weeks and vaccinating again at 1 year of age, revaccination need not be done more often than every 3 years.
9. The presence of serum antibody, regardless of titre, in an actively immunised cat over the age of 16 weeks is correlated with protection.

Precautions:

1. Concerns have been raised regarding the reversion to virulence of MLV strains, but this has never been documented. Nevertheless, in regions or facilities where FPV is not endemic in domestic or wild susceptible species, MLV vaccines should not be used.
2. MLV FPV vaccines should never be used in pregnant queens because of the risk of transfer of virus to the fetus and fetal damage. In some countries, inactivated FPV vaccines are licensed for use in pregnant queens, but in general, unnecessary administration of products to pregnant queens should be avoided.
3. MLV FPV vaccines should never be administered to kittens less than 4 weeks of age, to avoid damage to the cerebellum which is still developing in neonates.
4. MLV FPV vaccines should be used with caution in severely immunosuppressed individuals – although the risk appears small, with severe immunosuppression (for example with clinical FIV or FeLV infection or with the use of highly immunosuppressive drugs) failure to control viral replication could potentially lead to clinical signs after vaccination.
5. When vaccination is being used to control disease in the face of an outbreak, the more rapid induction of immunity induced by MLV vaccines is of clinical advantage.

Incubation Period:

After infection, it takes 2 to 7 days for signs of disease to appear. Vomiting usually develops 1-2 days after the onset of fever. Diarrhoea may begin later but is not always present. Dehydration develops rapidly, and an affected cat may sit at a water bowl, obviously thirsty, but without drinking. Terminal cases are hypothermic and may develop septic shock and disseminated intravascular coagulation. In the environment, the virus can remain infectious for one year or more. Therefore, all facilities where infected animals have been present must be considered infected.

FACT SHEET: FELINE HERPESVIRUS (FHV-1) VACCINES

Types of Vaccines Available:

1. **Modified Live Virus (MLV) Vaccines:** These preparations contain marginally attenuated feline herpesvirus (feline rhinotracheitis virus, occurring as a single serotype) at various titres, without adjuvant. There are injectable preparations and others for intranasal application, alone or in combination with other vaccinal antigens (always with feline calicivirus).
2. **Inactivated (Killed) Vaccines:** Adjuvanted killed and subunit vaccines have been developed.

Mechanisms and Duration of Immunity (DOI):

1. Assessment of the DOI is difficult. Complete clinical protection is seen only shortly after vaccination, and its efficacy decreases with time.
2. Immunity is far from solid after natural infection/disease, and of variable duration.
3. Protection afforded by FHV-1 (as well as the feline calicivirus) vaccines is not as complete as that seen with the feline panleukopenia vaccines. The other two feline core vaccines should not be expected to provide the same robust degree and duration of immunity as seen with the canine core vaccines.
4. Persistence of antibody titre after vaccination with a killed FHV-1 vaccine was demonstrated for 3 years.
5. After completing the kitten series at around 16 weeks and vaccinating again at 1 year of age, revaccination need not be done more often than every 3 years. If booster vaccinations have lapsed, a single injection is considered adequate if the interval since the last vaccination is <3 years; if it is >3 years, two vaccinations should be considered.
6. No herpesvirus vaccine can protect against infection with virulent virus; infection will become latent and may be reactivated during periods of severe stress. The reactivated virus may also cause clinical signs in vaccinated animals; the virus may be shed, transmitted to susceptible animals and cause disease in them.
7. Cell-mediated immunity plays an important role in protection, since the absence of detectable serum antibody levels in vaccinated cats does not necessarily indicate that cats are susceptible to disease. On the other hand, seroconversion does correlate with protection against virulent FHV-1 challenge.
8. Maternally derived antibody (MDA) interferes with active immunisation for varying periods of time in the kitten, depending on the titre of colostral antibody and the amount of antibody absorbed during the first 8 hours after birth. The primary course of vaccination is usually started at around 9 weeks of age, although some vaccines are licensed for use at an earlier age.

Precautions:

1. Modified live vaccines retain some pathogenic potential and may induce disease if administered incorrectly, i.e. when accidentally aerosolised or ingested from vaccine deposited on the skin/hair.
2. Upper respiratory disease signs are more commonly seen following intranasal vaccination.
3. In breeding catteries, infections mostly appear in kittens prior to weaning, typically between 4 and 8 weeks of age, as MDA wanes. In most cases, the source of infection is the queen, whose latent virus is reactivated due to the stress of parturition and lactation.

Incubation Period:

Viral excretion starts as soon as 24 hours after infection and lasts for 1 to 3 weeks. Acute disease appears after 2 to 6 days and resolves within 10 to 14 days. The virus spreads along the sensory nerves and reaches neurons, particularly in the trigeminal ganglia, which are the main sites of latency. Most cats become lifelong latent carriers, shedding the virus periodically, upon stressful events. Viral genomic DNA persists in the nucleus of infected neurons without replication. In the environment, the virus is labile and inactivated by common disinfectants.

FACT SHEET: FELINE CALICIVIRUS (FCV) VACCINES

Types of Vaccines Available:

1. **Modified Live Virus (MLV) Vaccines:** These preparations contain feline caliciviruses of several types without an adjuvant. There are injectable preparations and others for intranasal application, alone or in combination with other vaccinal antigens (always with feline herpesvirus).
2. **Inactivated (Killed) Vaccines:** Killed adjuvanted vaccines have been developed.

Mechanisms and Duration of Immunity (DOI):

1. There is considerable antigenic variability amongst FCV strains, but the virus is considered as a single serotype. Prior infection with one strain can significantly reduce the acute clinical signs upon exposure to a heterologous strain, and also oral virus shedding. In general, the level of heterologous protection depends on the pair of virus strains examined.
2. Virus neutralising antibodies first appear approximately 7 days after infection, their titre correlates well with protection against homologous challenge. Cats may also be protected in the absence of serum antibody, and cellular responses have been demonstrated in vaccinated cats.
3. After vaccination with a killed FCV vaccine, antibody has been shown to persist for 3 years. Accordingly, a DOI of >3 years has been established for FCV vaccines.
4. Protection afforded by FCV (as well as by feline herpesvirus) vaccines is not as complete as that seen with the feline panleukopenia vaccines. The two core respiratory vaccines should not be expected to provide the same robust degree and duration of immunity as seen with feline parvovirus or the canine core vaccines.
5. After completing the kitten series at around 16 weeks and vaccinating again at 1 year of age, revaccination need not be done more often than every 3 years.
6. Maternally derived antibodies (MDA) are important for protection during the first weeks of life and may interfere with vaccination. The average half-life of MDA was determined to be 15 days with persistence for 10-14 weeks. In a field study, about 20% of kittens at six weeks of age had no detectable antibodies against a widely used vaccine strain.

Precautions:

1. Upper respiratory disease signs are more commonly seen following intranasal vaccination.
2. Because of the multitude of antigenically differing viruses circulating in the field, vaccine strain combinations have been chosen to cross-protect against severe clinical disease - but mild disease may still occur in vaccinated cats.
3. In contrast to feline herpesvirus, which is shed upon a stressful event, shedding of FCV is continuous. The impact of vaccination on shedding is controversial, with observations ranging from moderate reduction to extension of the period of virus shedding post infection. Live parenteral FCV vaccine strains can be shed, although infrequently.

Incubation Period:

FCV infection can cause acute oral and upper respiratory signs but has also been associated with chronic gingivostomatitis, which may be immune-mediated. Acute oral and upper respiratory disease signs are mainly seen in kittens. The incubation period is 2 to 10 days. Oral ulceration, sneezing and serous nasal discharge are the main signs.

Recently, a new syndrome, the “virulent systemic feline calicivirus (VS-FCV) disease” has been described. The incubation period for this infection in cats exposed in shelters and hospitals is 1-5 days; in the home environment it may be up to 12 days. This disease appears to be more severe in adults than kittens. Vaccination with current vaccines does not protect cats against field infections, but some protection has been shown experimentally. This might be due either to the inherent characteristics of the hypervirulent strains or to the fact that “vaccine susceptible” strains are unlikely to cause outbreaks, since vaccination is so widely practiced.

FREQUENTLY ASKED QUESTIONS (FAQ)

- 1. Is there a risk of over-vaccinating a pet (e.g. injecting it too often, or using vaccines that are not required for the specific pet)?**
Yes – Vaccines should not be given needlessly, as they may cause adverse reactions. Vaccines are medical products that should be tailored to the needs of the individual animal.
- 2. May I mix different types of vaccines in the syringe?**
No - One should never mix different vaccine preparations in the syringe unless specified by the data sheet.
- 3. May I co-inject different vaccines (not part of a single commercial product) into the same animal?**
Yes – but different vaccines should be injected into separate sites that are drained by different lymph nodes.
- 4. May I use smaller vaccine doses in small breeds to reduce the risk of adverse reactions?**
No - The volume (e.g. 1.0 ml) as recommended by the manufacturer generally represents the minimum immunising dose, therefore the total amount must be given.
- 5. Should the large dog (Great Dane) be injected with the same volume of vaccine as the small dog (Chihuahua)?**
Yes - Unlike pharmaceuticals that are dose-dependent, vaccines are not based on volume per body mass (size), but rather on the minimum immunising dose.
- 6. May I vaccinate the anaesthetised patient?**
It is best not to do this if possible - the patient may develop a hypersensitivity reaction and vomit, leading to an increased risk of aspiration. Also, anaesthetic agents may be immunomodulatory.
- 7. May I vaccinate pregnant pets?**
No - Vaccination with MLV and killed products during pregnancy should be avoided, if at all possible.
- 8. May I vaccinate pets that are on immunosuppressive or cytotoxic therapy (e.g. for cancer or immune-mediated diseases, such as those with an autoimmune or hypersensitivity pathogenesis)?**
No - Vaccination especially with MLV products should be avoided as they may cause disease; vaccination with killed products may not be effective or may aggravate the immune-mediated disease.
- 9. How long after stopping immunosuppressive therapy do I wait before vaccinating a pet?**
A minimum of 2 weeks.
- 10. May I vaccinate every week if an animal is at high risk of disease?**
No - Vaccines should not be given more often than every other week, even when different vaccines are being given.
- 11. When should the last vaccine dose be given in the puppy and kitten vaccine series?**
The last dose of vaccine should be given at around 16 weeks of age.
- 12. May I inject a killed vaccine, followed at a later time with a MLV for the same disease?**
No - The killed vaccine may induce an effective antibody response that will neutralise the MLV in the vaccine, thereby preventing immunisation. It would be preferable to give the MLV vaccine first and if/when needed, revaccinate with the killed vaccine preparation.
- 13. May I inject a modified live intranasal *Bordetella* vaccine?**
No - The vaccine can cause a severe local reaction and may even kill the pet.
- 14. May I give a killed *Bordetella* vaccine destined for parenteral use intranasally?**
No - This will not stimulate a specific response to the *Bordetella*; you should give a live vaccine via the intranasal route, as specified by the data sheet.
- 15. Are precautions necessary when using MLV FHV-1/FCV parenteral vaccines in cats?**
Yes - Mucosal (e.g. conjunctival and nasal) contact with the preparation must be avoided, because the vaccine virus can cause disease.
- 16. Can nosodes (holistic preparations) be used to immunise pets?**
No - Nosodes cannot be used for the prevention of any disease. They do not immunise because they do not contain antigen.
- 17. Should dogs and cats with a history of adverse reaction or immune-mediated diseases (hives, facial oedema, anaphylaxis, injection site sarcoma, autoimmune disease, etc.) be vaccinated?**
If the vaccine suggested to cause the adverse reaction is a core vaccine, a serological test can be performed, and if the animal is found seropositive (antibody to CDV, CPV-2, FPV) revaccination is not necessary. If the vaccine is an optional non-core vaccine (e.g. *Leptospira* bacterin) revaccination is discouraged. For rabies, the local authorities must be consulted to determine whether the rabies vaccine is to be administered by law or whether antibody titre may be determined as an alternative.

18. May I use different vaccine brands (manufacturers) during the vaccination program?

Yes – It may even be desirable to use vaccines from different manufacturers during the life of an animal, because different products may contain different serotypes (e.g. of feline calicivirus).

19. Should I use a disinfectant (e.g. alcohol) on the injection site?

No - The disinfectant might inactivate an MLV product, and it is not known to provide a benefit.

20. Can vaccines cause autoimmune diseases?

Vaccines themselves do not cause autoimmune disease, but in genetically predisposed animals they may trigger autoimmune responses followed by disease – as can any infection, drug, or a variety of other factors.

21. May I split vaccines in combination products?

Yes - For example, *Leptospira* bacterins are often the diluent for the viral antigen combination. The “viral cake” may be resuspended in sterile water, and the *Leptospira* bacterin be given separately at another site or time, or discarded.

22. Will a single vaccine dose provide any benefit to the dog or cat?

Will it benefit the canine and feline populations?

Yes - One dose of a MLV canine core vaccine (CDV, CPV-2 CAV-2) or a feline core vaccine (FPV, FCV, FHV-1) should provide long term immunity when given to animals at or after 16 weeks of age. Every puppy and kitten 16 weeks of age or older must receive at least one dose of the MLV core vaccines. If that were done, herd (population) immunity would be significantly improved. Even in the USA with its good vaccination record, probably <50% of all puppies and <25% of all kittens ever receive a vaccine. We must vaccinate more animals in the population with core vaccines to achieve herd immunity (e.g. 75% or higher) and prevent epidemic outbreaks.

23. When an animal first receives a vaccine that requires two doses to immunise (e.g. killed vaccines like *Leptospira* bacterins or feline leukemia virus), and it does not return for the second dose within ≤6 weeks, is there any immunity?

No - A single dose of a two-dose vaccine does not provide immunity. The first dose is for priming the immune system, the second for boosting. If a second dose is not given within 6 weeks of the first, the regime must start again, making sure the two doses are given within 2 to 6 weeks. After those two doses, revaccination with a single dose can be done at any time.

24. May I give a MLV product to a wild, exotic species or to a domestic species other than to the ones which the vaccine was licensed to protect?

No - Never. Many MLV vaccines have caused disease in animal species other than those for which they had been licensed. Even worse: the vaccine could be shed from those animals, regain virulence through multiple passages and cause disease even in the target species for which it had been developed. The consequences could be catastrophic!

A highly effective and very safe vaccine for species that are susceptible to CDV is a canary poxvirus-vectored recombinant CDV vaccine that is available as a monovalent product for ferrets or a combination product for dogs. The monovalent vaccine is being used in many wild and exotic species susceptible to CDV.

25. May I vaccinate a puppy that is at high risk of getting CDV with a human measles vaccine?

No - Due to an insufficient amount of virus, the human MV vaccine is not immunogenic in the puppy. Measles virus vaccines made specifically for the dog (sometimes combined with CDV) will give temporary protection at an earlier age than a CDV vaccine. At 16 weeks or older, the puppy must be vaccinated with a CDV vaccine, to achieve permanent immunity.

26. I know that maternally derived antibodies (MDA) can prevent active immunisation with MLV vaccines - but can they also block immunity to killed vaccines?

Yes - MDA can indeed block certain killed vaccines. If the killed product requires two doses, as is often the case, and the first dose is blocked by MDA, then the second dose will not immunise. In this circumstance, the second dose will prime (if not blocked), and a third dose is required to boost and immunise.

This is not true for MLV, where - in the absence of MDA - it only takes a single dose to prime, immunise, and boost. Nevertheless two doses are often recommended, particularly in young animals, to be sure one is given when MDA cannot block. That is why in the puppy or kitten series, the last dose should be given at around 16 weeks of age or later.

27. I have been told that certain canine MLV combination core products need only be given twice, with the last dose at an age as young as 10 weeks. Is that accurate?

The VGG is aware that certain canine vaccines are licensed for such an ‘early finish’ in order to allow pups the benefit of early socialisation. The VGG accepts the behavioural benefits of this practice but has reservations about its immunological validity. No combination core product currently available will immunise an **acceptable percentage** of puppies when the last dose is given at 10 weeks of age. The VGG advises that wherever possible the last dose should be given at around 16 weeks of age, regardless of the number of doses given earlier. Where the ‘early finish’ protocol is adopted, the VGG recommends that owners carefully control the exposure of their pup to restricted environments and only permit contact with healthy and fully vaccinated puppies.

28. For how long can a reconstituted MLV vaccine sit at room temperature without losing activity?

At room temperature, some of the more sensitive vaccines (e.g. CDV, FHV-1) will lose their ability to immunise in 2 to 3 hours, whereas other components will remain immunogenic for several days (e.g. CPV, FPV).

29. May I give the same type of vaccine parenterally and intranasally, for example the canine and feline vaccines used to prevent respiratory diseases ('kennel cough' and feline upper respiratory disease)?

Yes - But be sure to give the product approved for that route. If you use the parenteral MLV vaccines containing FCV and FHV-1 locally, you could cause disease in the cat. If you use the killed FCV and FHV-1 vaccines locally, you would not get any immunity and might cause significant adverse reactions. If you gave the intranasal live 'kennel cough' vaccine parenterally, you could cause a severe necrotising local reaction and even kill the dog, whereas giving the parenteral killed *Bordetella* vaccine intranasally will not immunise and may cause a hypersensitivity reaction.

However, both types of products can be given at the same time or at various times in the life of the animal. Vaccinating both parenterally and intranasally may actually provide better immunity than vaccinating at only one site. Thus parenteral vaccination provides protection in the lung but little or no immunity in the upper respiratory tract (especially local secretory IgA and CMI), whereas intranasal vaccination will engender good secretory IgA and local CMI and non-specific immunity (e.g. type I interferons), but will not always provide immunity in the lung.

30. Are there dogs and cats that cannot develop an immune response to vaccines?

Yes - This is a genetic characteristic seen particularly in some breeds, and these animals are called 'non-responders'. Genetically related (same family or same breed) animals will often share this non-responsiveness. If the animal is a non-responder to a highly pathogenic agent, like canine parvovirus or feline panleukopenia virus, the infected animal will die if infected. If it is a non-responder to a pathogen that rarely causes death, it may become very sick but will survive (e.g. after a *Bordetella bronchiseptica* infection).

31. Are there mutants (biotypes or genotypes) of CDV or CPV-2 in the field that the current vaccines cannot provide protective immunity against?

No - All the current CDV and CPV-2 vaccines provide protection from all the known isolates of CDV or CPV-2, respectively, when tested experimentally as well as in the field.

32. How long after vaccination does it take for the dog to develop immunity that will prevent severe disease when the core vaccines are used?

This is dependent on the animal, the vaccine, and the disease.

- The fastest immunity is provided by CDV vaccines – MLV and recombinant canarypox virus vectored. The immune response starts within minutes to hours and provides protection within a day to animals without interfering levels of MDA and dogs that are not severely immunosuppressed.
- Immunity to CPV-2 and FPV develops after as few as 3 days and is usually present by 5 days when an effective MLV vaccine is used. In contrast, the killed CPV-2 and FPV-2 vaccines often take 2 to 3 weeks or longer to provide protective immunity.
- CAV-2 MLV given parenterally would provide immunity against CAV-1 in 5 to 7 days; when given intranasally, however, the same level of immunity to CAV-1 is not present until after 2 or more weeks.
- Time from vaccination to immunity is difficult to determine for FCV and FHV-1 because some animals will not develop any immunity.

33. Will the current 'kennel cough' vaccines provide any protection from disease caused by the new canine influenza virus?

No - The racing greyhounds that have been found infected and that developed disease had been routinely vaccinated 3 or more times a year with commercial 'kennel cough' vaccines. Canine influenza virus is antigenically unrelated to any other virus of dogs, but related to Equine Influenza Virus.

34. If an animal has gone beyond the time that is generally considered to be the maximum DOI for the vaccine (7 to 9 years for CDV, CPV-2, CAV-2; >1 year for *Leptospira*, *Bordetella bronchiseptica*; >3 years for rabies), do I have to start the series of vaccinations again (multiple doses 2 to 4 weeks apart)?

No - For MLV vaccines, multiple doses are only required at the puppy or kitten age, when an animal has MDA. The VGG is aware that many data sheets do advise re-starting a vaccination series, but does not endorse this practice which is inconsistent with fundamental immune system function.

35. What can I expect from the core vaccines in terms of efficacy in the properly vaccinated puppy/dog and kitten/cat?

- Dogs properly vaccinated with MLV or recombinant CDV, CPV-2 and CAV-2 would have $\geq 98\%$ protection from disease. Similarly we would expect a very high protection from infection.
- For the properly vaccinated cat that had received MLV vaccines, we would estimate that $\geq 98\%$ would be protected from disease and infection with FPV.
- In contrast, we can expect FCV and FHV-1 vaccines, at best, to protect from disease, especially in a highly contaminated environment (e.g. shelter) and protection would be seen in 60 to 70% in a high risk environment and higher in the household pet cat.

36. Are serum antibody titres useful in determining vaccine immunity?

Yes - Especially for CDV, CPV-2 and CAV-1 in the dog, FPV in the cat and rabies virus in the cat and dog. Serum antibody titres are of limited or no value for the other vaccines. Assays for CMI are of little or no value for any of the vaccines for various technical and biological reasons. Such factors are less of an issue for serological tests where it is much easier to control many of the variables. However, discrepant results are still obtained, depending on the quality assurance program of the given laboratory.

37. Do puppies develop immunosuppression after the initial series of core vaccines?

Yes - If a combination product containing MLV-CDV and MLV-CAV-2 with other components is used, a period of immunosuppression lasting approximately 1 week develops, beginning 3 days after vaccination. If the combination vaccine does not contain either MLV-CDV or MLV-CAV-2, then such suppression does not occur.