Canine adenovirus pdf test 2 questions 1

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The WSAVA Vaccination Guidelines Group (VGG) was convened in order to develop guidelines for the vaccination of dogs and cats that have global application. The first version of these guidelines was published in 2007 and they were updated in 2010. The present document provides an updated and expanded version of these international guidelines for the vaccination of small companion animals and indicates the scientific evidence base on which the recommendations are made. 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. These guidelines are not a mandatory edict, but rather should be used by national associations and individual veterinary practices to develop vaccination schedules relevant to the local situation. However, the VGG strongly recommends that wherever possible ALL dogs and cats receive the benefit of vaccination. This not only protects the individual animal, but provides optimum 'herd immunity' that minimizes the likelihood of infectious disease outbreaks.With this background in mind, the VGG has defined core vaccines as those which ALL dogs and cats, regardless of circumstances or geographical location, should receive. Core vaccines protect animals from severe, life-threatening diseases that have global distribution. Core vaccines for dogs are those that protect against canine distemper virus (CDV), canine adenovirus (CAV) and the variants of canine parvovirus type 2 (CPV-2). Core vaccines for cats are those that protect against feline parvovirus (FPV), feline calicivirus (FCV) and feline herpesvirus-1 (FHV-1). In areas of the world where rabies virus infection is endemic, vaccination against this agent should be considered core for both species, even if there is no legal requirement for routine vaccination.The VGG recognizes that maternally derived antibody (MDA) significantly interferes with the efficacy of most current core vaccines administered to pups and kittens in early life. As the level of MDA varies significantly among litters, the VGG recommends the administration of multiple core vaccine doses to pups and kittens, with the final dose of these being delivered at 16 weeks or older or above and then followed by a booster at 6- or 12-months of age. 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 older.The VGG supports the use of simple in-practice tests for determination of seroconversion to the core vaccine components (CDV, CAV, CPV-2 and FPV) following vaccination, for determination of seroprotection in adult dogs and for management of infectious disease outbreaks in shelters.Vaccines should not be given needlessly. Core vaccines should not be given any more frequently than every three years after the 6- or 12-month booster injection following the puppy/kitten series, because the duration of immunity (DOI) is many years and may be up to the lifetime of the pet.The VGG has defined non-core vaccines as those that are required by only those animals whose geographical location, local environment or lifestyle places them at risk of contracting specific infections. The VGG has also classified some vaccines as not recommended (where there is insufficient scientific evidence to justify their use) and has not considered a number of minority products which have restricted geographical availability or application.The VGG strongly supports the concept of regular (usually annual) health checks which removes the emphasis from, and client expectation of, annual revaccination. The annual health check may still encompass administration of selected non-core vaccines which should be administered annually, as the DOI for these products is generally 1 year.The VGG has considered the use of vaccines in the shelter environment, again recognizing the particular circumstances of such establishments and the financial constraints under which they sometimes operate. The VGG minimum shelter guidelines are simple: that all dogs and cats entering such an establishment should be vaccinated before, or at the time of entry, with core vaccines. Where finances permit, repeated core vaccines should be administered as per the schedules defined in the guidelines and non-core vaccines against respiratory disease may be included.The VGG recognizes the importance of adverse reaction reporting schemes, but understands that these are variably developed in different countries. Wherever possible, veterinarians should be actively encouraged to report all possible adverse events to the manufacturer and/or regulatory authority to expand the knowledge base that drives development of improved vaccine safety.These fundamental concepts proposed by the VGG may be encapsulated in the following statement: We should aim to vaccinate every animal with core vaccines. Non-core vaccines should be given no more frequently than is deemed necessary. The concept of evidence-based veterinary medicine (EBVM) has become increasingly prominent since the WSAVA vaccination guidelines were first published in 2007. Categories defining the weight of evidence underlying any procedure in veterinary practice (e.g. medical, surgical or diagnostic procedures or the administration of pharmaceuticals) have been defined and applied previously to European recommendations for feline vaccination (Lloret, 2009). The VGG aimed for the current update of the WSAVA global vaccination guidelines to adopt a more explicitly evidence-based approach, so that practitioners could be made aware of the nature of evidence that underpins the recommendations made. Accordingly, this document is more fully referenced than previous iterations of the guidelines. Additionally, the VGG wished to apply a ranking of supportive evidence, but found that the currently used schemes were poorly applicable to the specialist area of vaccinology. For this reason, the VGG has developed its own EBVM classification, proposing four levels of evidence related to investigations of small companion animal vaccination. These are: Category 1 evidence: a recommendation supported by peer-reviewed scientific publication of either experimental or field data. Evidence within this category might still be of variable scientific quality despite peer review, as the peer review process does not conform to a universal standard. Category 2 evidence: a recommendation supported by unpublished commercially sensitive studies submitted as part of a regulatory package for licensed veterinary vaccines. The assumption for this level of evidence is that information appearing on the datasheets of licensed products has been through competent peer review by regulatory authorities. Category 3 evidence: a recommendation supported by commercial or independent experimental or field data that have not been published in the peer reviewed scientific literature or were not included in a formal regulatory package and subjected to scrutiny by regulators. Category 4 evidence: a recommendation unsupported by experimental or field data, but assumed from knowledge of the 'first principles' of microbiology and immunology or supported by widely-held expert opinion.Throughout this document, statements may be followed by a qualifier [EB1], [EB2], [EB3] or [EB4] reflecting an 'evidence base' of category 1, 2, 3 or 4, respectively. For each occasion of use only the most rigorous level of evidence available will be given.These WSAVA vaccination guidelines do NOT serve as a set of globally-applicable rules for the administration of vaccines to dogs and cats. It is simply not possible to produce a set of guidelines that applies equally to each of the 80 WSAVA member nations as there are vast differences between countries and geographical regions with respect to infectious disease presence/absence or prevalence, vaccine product availability, owned versus free-roaming dog and cat populations, practice and client economics and societal attitudes.Instead, these guidelines are intended to provide national small animal veterinary associations and WSAVA members with current scientific advice and best practice vaccination concepts. It is up to national associations or individual practices to read, discuss and adapt these guidelines for their own particular practice situations. These guidelines are not proscriptive; for example, it is entirely possible that what might be considered a non-core vaccine in many countries, or particular geographical regions, might be used as a core vaccine elsewhere.Practitioners are sometimes alarmed that guidelines recommendations appear contrary to those given on the product datasheet (or 'summary of product characteristics' [SPC] in Europe), and therefore feel that if they adopt guidelines recommendations, they are leaving themselves open to litigation. The distinct difference between a datasheet and a guidelines document has been clearly discussed by Thiry and Horzinek (2007).The data sheet or SPC is a document that forms part of the registration process for a specific vaccine. A datasheet will give details of the quality, safety and efficacy of a product and in the case of vaccines will describe the minimum duration of immunity (DOI) of the product. The DOI is based on experimental evidence (i.e. how long after vaccination is an animal protected from infection or disease as determined by challenge with virulent infectious agent), represents a minimum value and need not reflect the true DOI of a vaccine. Most companion animal core vaccines, until relatively recently, had a 1-year minimum DOI and carried a recommendation for annual revaccination. In more recent years many of the same products have been licensed with a minimum DOI of 3 (or sometimes 4) years. In fact, in many countries the majority of core MLV vaccines are now licensed for triennial revaccination of adult animals. However, there are many other countries in which the identical products still carry a 1-year minimum DOI; simply because the manufacturer has not applied for a change in its product label recommendations or because the national licensing authority has not permitted the change to be made. This unfortunate situation does lead to confusion amongst practitioners in those countries. Above all, it must be remembered that even a 3-year license is a minimum DOI for core vaccines and for most core vaccines the true DOI is likely to be considerably longer, if not lifelong, for the majority of vaccine recipients.Therefore, there will remain instances where the guidelines may recommend triennial or less frequent revaccination, but all available products in a particular country still carry a 1-year licensed DOI. In this instance, the veterinarian may use a vaccine according to guidelines (and therefore current scientific thinking) by obtaining informed (and documented) owner consent for this deviation from manufacturer's recommendations ('off-label use'). Veterinarians should also be aware that company technical representatives will continue to advise that the veterinarian must adhere to the recommendations given in their datasheets, as they are obliged to do since these documents have been through the licensing procedure.Further confusion may arise when veterinarians compare the recommendations given in different sets of guidelines. There are, for example, subtle differences in recommendations made in different countries that reflect differences in the opinions of local expert groups, the prevalence of particular infectious diseases and in the typical lifestyles of pet animals that may make them more or less exposed to infections. The VGG faces the difficult challenge of setting a middle-course through various national or regional guidelines. Its recommendations attempt to provide a balanced perspective to account for global differences in the keeping of small companion animals.In summary, veterinarians should feel comfortable about vaccinating according to the schedules given in these guidelines, but should cross-reference these with local recommendations where available. Where the VGG recommendations differ from current product label recommendations the practitioner needs to be sure to obtain informed client consent in order to use the vaccine in accordance with the VGG recommendations.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, some of the major infectious diseases of dogs and cats are considered at most uncommon in the pet population. However, even in those countries there remain geographical pockets of infection and sporadic outbreaks of disease may occur, and the situation regarding free-roaming or shelter populations is distinctly different from that in owned pet animals. 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. The global economic recession post-2008 has had further impact on the uptake of preventive healthcare by pet owners in developed countries and survey data suggests a recent decline in vaccination (Anon 2013a).In small animal medicine, we have been slow to grasp the concept of 'herd immunity' – that vaccination of individual pet animals is important, not only to protect the individual, but to reduce the number of susceptible animals in the regional population, and thus the prevalence of disease. Herd immunity related to use of core vaccines that provide a long (many years) DOI is highly dependent on the percentage of animals in the population vaccinated and not the number of vaccinations that occur annually. Therefore, every effort should be made to vaccinate a higher percentage of cats and dogs with the core vaccines. It is simply not possible to induce 'better' immunity in an individual animal by giving repeated vaccinations, i.e. a dog receiving a core MLV vaccine every 3 years will be equally well protected compared with one receiving the same vaccine annually (Bohm et al. 2004, Mouzin et al. 2004, Mitchell et al. 2012) [EB1], but this may not necessarily be the case for feline core vaccines (see below).In recent years the re-emerging concept of 'One Health' has also impacted on the field of vaccinology. The management of infectious diseases through the collaborative interaction of human medical, animal and environmental healthcare professionals provides a rational and cost-effective goal at a time when the majority of newly emergent human infectious diseases is proposed to derive from wild or domestic animal sources (Gibbs 2014). The WSAVA has embraced the One Health concept with establishment of a One Health Committee in 2010 (Day 2010), the work of which overlaps with that of the VGG when tackling the major small companion animal zoonoses of canine rabies and leishmaniosis.A second major concept regarding vaccination of dogs and cats has been the recognition that we should aim to reduce the 'vaccine load' on individual animals in order to minimize the potential for adverse reactions to vaccine products and reduce the time and financial burden on clients and veterinarians of unjustified veterinary medical procedures. For these reasons we have seen the development of vaccination guidelines based on a rational analysis of the vaccine requirements for each pet, and the proposal that vaccines be considered 'core' and 'non-core' in nature. To an extent this categorization of products has been based on available scientific evidence and personal experience – but concerted effort to introduce effective companion animal disease surveillance on a global scale would provide a more definitive basis on which to recommend vaccine usage (Day et al. 2012). In parallel with the categorization of vaccines has been the push towards marketing products with extended DOI, to reduce the unnecessary administration of vaccines and thereby further improve vaccine safety. Both of these changes have necessitated a frame-shift in the mind-set of veterinary practitioners, which is now becoming the accepted norm in many countries.The following VGG guidelines are prepared when considering the optimum model of committed pet owners, willing and able to bring their animals to the veterinarian, for the full recommended course of vaccination. The VGG is aware that there are less committed or able pet owners in every country and there are countries where severe financial or societal constraints often determine the nature of the vaccine course that can 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 greater than 16 weeks of age.The VGG has additionally considered vaccination in the shelter situation. The guidelines that we have proposed are those that we consider provide 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 further towards more rational use of vaccines in these species. The most important message of the VGG is therefore encapsulated in the following statement: We should aim to vaccinate every animal with core vaccines. Non-core vaccines should be given no more frequently than is deemed necessary. 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 dogs throughout the world must receive, at recommended intervals, in order to provide life-long protection against infectious diseases of global significance. The core vaccines for the dog are those that confer protection against infection by canine distemper virus (CDV), canine adenovirus (CAV; types 1 and 2) and canine parvovirus type 2 (CPV-2) and its variants. The VGG recognizes that particular countries will identify additional vaccines that they consider core. A particular example of a vaccine that may be considered core in only some countries is that against rabies virus. In a geographical area in which this infection is endemic, all dogs should be vaccinated routinely for the protection of both the pet and human populations. The VGG strongly endorses the joint statement of the WSAVA One Health Committee and the International Organisation for Animal Health (OIE) which sets a target for global elimination of canine rabies by 2030 (Anon 2013b). In many countries, rabies vaccination is a legal requirement, and is generally also required for international pet travel.WSAVA Canine Vaccination GuidelinesVaccineInitial Puppy VaccinationInitial Adult Vaccination Revaccination RecommendationComments and Recommendations Canine Parvovirus-2 (CPV-2; MLV, parenteral) Canine Distemper Virus (CDV; MLV, parenteral) Recombinant Canine Distemper Virus (rCDV, parenteral) Canine Adenovirus-2 (CAV-2; MLV, parenteral) Administer at 6–8 weeks of age, then every 2–4 weeks until 16 weeks of age or older [EB1].Two doses 2–4 weeks apart are generally recommended by manufacturers, but one dose of MLV vaccine or rCDV is considered protective [EB4].Revaccination (booster) at either 6 months or 1 year of age, then not more often than every 3 years.Core CPV-2 (killed, parenteral) Not recommended where MLV available.Canine Adenovirus-1 (CAV-1; MLV and killed parenteral)Not Recommended where CAV-2 MLV available.Rabies (killed parenteral) Administer one dose at 12 weeks of age. If vaccination is performed earlier than 12 weeks of age, the puppy should be revaccinated at 12 weeks of age. In high risk areas a second dose may be given 2–4 weeks after the first. Administer a single dose.Revaccination (booster) at 1 year of age. Canine rabies vaccines with either a 1- or 3-year DOI are available. Timing of boosters is determined by this licensed DOI, but in some areas may be dictated by statute.Core where required by statue or in areas where the disease is endemic. Parainfluenza Virus (CPiV; MLV, parenteral) Administer at 6–8 weeks of age, then every 2–4 weeks until 16 weeks of age or older [EB4].Two doses 2–4 weeks apart are generally recommended by manufacturers, but one dose is considered protective [EB4].Revaccination (booster) at either 6 months or 1 year of age, then annually.Non-core. Use of CPiV (MLV-intranasal) is preferred to the parenteral product as the primary site of infection is the upper respiratory tract. Bordetella bronchiseptica (live avirulent bacteria, intranasal) B. bronchiseptica + CPiV (MLV) intranasal B. bronchiseptica + CPiV (MLV) + CAV-2 (MLV) intranasal Administer a single dose as early as 3 weeks of age. A single dose.Annually or more often in very high-risk animals not protected by annual booster.Non-core. B. bronchiseptica is available as a single product or in combination with CPiV or with both CPiV and CAV2. Transient (3–10 days) coughing, sneezing, or nasal discharge may occur in a small percentage of vaccinates. Intranasal or oral vaccines MUST NOT be delivered by parenteral injection as this may lead to severe adverse reactions, including death. B. bronchiseptica (live avirulent bacteria, oral) The current manufacturer's recommendation is for use of this vaccine from 8 weeks of age. Bordetella bronchiseptica (killed bacterin, parenteral Bordetella bronchiseptica (cell wall antigen extract, parenteral) Administer one dose at 6–8 weeks and one dose at 10–12 weeks of age.Two doses 2–4 weeks apart.Annually or more often in very high-risk animals not protected by annual booster.Non-core. Intranasal or oral products are preferred to the killed parenteral to provide local protection [EB4]; however, a review published at the time of compilation questions this advantage (Ellis 2015). Borrelia burgdorferi (Lyme borreliosis; killed whole bacterin, parenteral) Borrelia burgdorferi (rLyme borreliosis) (recombinant-Outer surface protein A [OspA], parenteral) Recommendation is for initial dose at 12 weeks of age or older. A second dose is given 2–4 weeks later. Borrelia vaccines may be given as early as 9 weeks of age if there is a high risk of exposure. For some vaccines, this will constitute off-label use.Two doses, 2–4 weeks apart.Annually. Revaccinate just prior to start of tick season as determined regionally.Non-core. Generally recommended only for use in dogs with a known high risk of exposure, living in or visiting regions where the risk of vector tick exposure is considered to be high, or where disease is known to be endemic. Leptospira interrogans (with serogroups canicola and icterohaemorrhagiae; killed bacterin, parenteral) Also available in the USA and some other countries with serogroups grippotyphosa and pomona, in Europe with serogroups grippotyphosa and australis, and in Europe with serogroup grippotyphosa. In Australia there is a monovalent vaccine containing serogroup australis and in New Zealand monovalent serogroup icterohaemorrhagiae vaccines are available. Initial dose at 8 weeks of age or older. A second dose is given 2–4 weeks later.Two doses 2–4 weeks apart. Annually. Non-core. Leptospira vaccines have been developed to account for the known circulating pathogenic serogroups in different geographical areas. Note that Leptospira serogroups may include multiple serovars. There is often confusion with the use of the terms 'serogroup' and 'serovar'. Vaccination should be restricted to use in geographical areas where a risk of exposure has been established or for dogs whose lifestyle places them at risk. This vaccine is known to provide protection that is less robust and may be of shorter duration, and therefore these products must be administered annually [EB1]. In the past, Leptospira bacterin vaccines have been suggested to be linked to a higher prevalence of allergic adverse events – particularly in small breed dogs. The evidence base for this is low [EB4] and one published study indicates no greater risk from Leptospira bacterins (Moore et al. 2005) [EB1]. The European Consensus Statement on Leptospirosis (Schuller et al. 2015) also takes this view. Canine influenza virus (CIV; H3N8; killed adjuvanted, parenteral)Two doses 2–4 weeks apart with initial dose at >6 weeks of age.Two doses 2–4 weeks apartAnnuallyNon-core. Licensed only in USA. Consider for at-risk groups of co-housed dogs such as those in kennels, dog shows or day care [EB1].Canine Coronavirus (CCV; killed and MLV, parenteral)Not Recommended. CCV infections are usually subclinical or cause mild clinical signs. Prevalence of confirmed CCV disease does not justify use of currently-available vaccines. There is no evidence that existing vaccines would protect against pathogenic variants of CCV (Buonavoglia et al. 2009, Decaro et al. 2009) [EB1]. Although CCV can be isolated commonly, the VGG remains unconvinced that CCV is a significant primary enteric pathogen in the adult dog. No studies have satisfied Koch's postulates for this infectious agent.Non-core vaccines are those for which use is determined on the basis of the geographical and lifestyle exposure risks of the individual and an assessment of risk–benefit ratios (i.e. the risk of being unvaccinated and susceptible or the risk of being vaccinated and developing an adverse reaction versus the benefit of being protected against the infection in question). Not recommended vaccines are those for which there is little scientific justification (insufficient evidence base) for their use.Most puppies are protected by MDA in the first weeks of life. In most puppies, passive immunity will have waned by 8–12 weeks of age to a level that allows active immunization. Puppies 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 (Friedrich & Truyen 2000) [EB1]. No single primary vaccination policy will therefore cover all possible situations. The recommendation of the VGG is for initial core vaccination at 6–8 weeks of age, then every 2–4 weeks until 16 weeks of age or older. Therefore the number of puppy primary core vaccinations will be determined by the age at which vaccination is started and the selected interval between vaccinations. Possible schedules are outlined in Table 5. By this recommendation, when vaccination is started at 6 or 7 weeks of age, a course of four primary core vaccines would be administered with a 4-week interval, but only three would be required with an 8- or 9-week start and a similar 4-week interval.Core Vaccination Schedules for Puppies and Kittens First Presented Between 6–9 Weeks of Age and Revaccinated Every 3 or 4 WeeksAge at first presentationCore vaccination schedule6 weeks 6 weeks, 9 weeks, 12 weeks, 16 weeks then 26 or 52 weeks or 6 weeks, 10 weeks, 14 weeks, 18 weeks then 26 or 52 weeks 7 weeks 7 weeks, 10 weeks, 13 weeks, 16 weeks then 26 or 52 weeks or 7 weeks, 11 weeks, 15 weeks, 19 weeks then 26 or 52 weeks 8 weeks 8 weeks, 11 weeks, 14 weeks, 17 weeks then 26 or 52 weeks or 8 weeks, 12 weeks, 16 weeks then 26 or 52 weeks 9 weeks 9 weeks, 12 weeks, 15 weeks, 18 weeks then 26 or 52 weeks or 9 weeks, 13 weeks, 17 weeks then 26 or 52 weeks In contrast, many vaccine datasheets continue to recommend an initial course of two injections of core vaccine. Some products are also licensed with a '10 week finish' designed such that the second of two core vaccinations is given at 10 weeks of age. The rationale behind this protocol is to permit 'early socialization' of puppies while diminishing the risk of infectious diseases. The VGG recognizes that early socialization is essential to the behavioural development of dogs (Korbelik et al. 2011, AVSAB 2008) [EB1]. Where such protocols (i.e. 'puppy classes') are adopted, vigilance should still be maintained by the owner – allowing restricted exposure of their puppy to controlled areas and only to other puppies and adults that appear healthy and are fully vaccinated. In particular 'puppy classes' should be held in venues away from the veterinary practice. Alternatively, if it is decided that veterinary premises must be used, the floors should be cleaned and disinfected before each class and the classes held in an area not highly trafficked by dogs of unknown vaccination or disease status. A recent US study has shown the minimal risk for CPV-2 amongst vaccinated puppies attending socialization classes (Stepita et al. 2013). The VGG recommends that whenever possible the last of the puppy primary series of core vaccines be given at 16 weeks of age or older [EB1].An integral part of core vaccination of puppies is the 'booster' vaccine that has traditionally been given either at 12 months of age or 12 months after the last of the primary series of puppy vaccines. The main aim of this vaccine is to ensure that a protective immune response develops in any dog that may have failed to respond to any of the vaccines in the primary core series, rather than necessarily 'boosting' the immune response. The delivery of this vaccine at 12 months of age is likely to have been chosen historically as a convenient time to request the owner to attend the practice for a first annual health check. This therefore implies that should an individual puppy fail to respond to any of the primary core vaccinations, that puppy may be unprotected until it receives this 12-month vaccine. This might account for occurrences of infectious disease (e.g. canine parvoviral enteritis) in a proportion of vaccinated puppies at less than 12 months of age. The VGG has re-evaluated this practice and now suggests that veterinarians might wish to reduce this possible window of susceptibility by bringing forward this vaccine from 52 weeks to 26 weeks of age (or indeed at any time point between 26 and 52 weeks of age; however, 26 weeks of age provides a convenient timing). This practice will require that pet owners clearly understand why this is recommended, because as indicated in Table 5, adopting such a protocol will mean that vaccination started in a 6 or 7 week old puppy, might now entail up to five vaccine visits in the first 6 months of life. For core vaccines, after a 26 week 'booster', another core vaccine would not be required for at least another 3 years. This new recommendation for vaccination at 6 months of age as an alternative to vaccination at about 1 year of age is certainly not mutually exclusive to, and does not preclude, a 1-year or 16-month 'first annual health check'. Many veterinarians are understandably keen to check the animals under their care at around the time they reach skeletal maturity.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 (Bohm et al. 2004, Mouzin et al. 2004, Schultz 2006, Mitchell et al. 2012) [EB1]. Following the 26 or 52 week booster, subsequent revaccinations are given at intervals of 3 years or longer. It should be emphasized that triennial adult revaccination does not generally apply to killed core vaccines (except for rabies) nor to the non-core vaccines, and particularly not to vaccines containing bacterial antigens. Thus Leptospira, Bordetella and Borrelia (Lyme disease) products, but also parainfluenza virus components, require more frequent boosters for reliable protection (Ellis & Krakowka 2012, Klaasen et al. 2014, Ellis 2015, Schuller et al. 2015) [EB1].Therefore an adult dog may, according to these guidelines, still be revaccinated annually, but the components of these vaccinations may differ each year. Typically, core vaccines are currently administered triennially, with chosen non-core products being given annually. The VGG is aware that in some countries only multi-component products containing core and non-core combinations are available. The VGG would encourage manufacturers to make a full range of reduced-component vaccines (or at least separate core and non-core vaccines (Mitchell et al. 2012) available wherever possible.An adult dog that had received a complete course of core vaccinations as a puppy, including a 26 or 52 week booster, but that may not have been vaccinated regularly as an adult, requires only a single dose of MLV core vaccine to boost immunity (Mouzin et al. 2004, Mitchell et al. 2012) [EB1]. Similarly, an adopted adult dog (or puppy over 16 weeks of age) of unknown vaccination history requires only a single dose of MLV core vaccine to engender a protective immune response. Many vaccine datasheets will advise in these circumstances that the dog requires two vaccinations (as for a puppy), but this practice is unjustified and contrary to fundamental immunological principles [EB4]. Note again, that this does not apply to non-core vaccines, many of which will require two doses in an adult dog.Particular mention should be made of canine rabies vaccines. The VGG recommends that in any country in which canine rabies is endemic, vaccination of dogs should be strongly recommended to clients by veterinarians, even if not required by law. Revaccination intervals for canine rabies are often mandated by law. Internationally available killed rabies vaccines were initially produced with a licensed 1-year DOI and so statutes required annual revaccination. These same products now carry a 3-year DOI in many countries, where laws have been modified to incorporate this change. However, in some countries the legal requirement is at odds with the vaccine license and in others neither the vaccine license, nor the law, has been changed. Finally, some countries also have locally-manufactured rabies vaccines with a 1-year DOI that most likely cannot safely be extended to 3 years. Veterinarians should be mindful of the law, but where they have access to a product that confers a minimum of 3-years immunity, national associations might lobby to have the laws changed to match the current scientific evidence.Since publication of the 2010 guidelines there have been advances in the availability of rapid and simple in-practice serological test kits that can detect the presence of protective antibody specific for CDV, CAV and CPV-2 in individual dogs. These test kits complement the traditional laboratory-based modalities (i.e. virus neutralization and haemagglutination inhibition test) that remain the 'gold standards' for serological testing. Two commercially produced test kits are available and have been applied and validated in the practice and shelter setting (Gray et al. 2012, Litster et al. 2012) [EB1]. These test kits have proven popular with veterinarians who wish to be able to offer their clients an alternative to routine core revaccination at 3-yearly intervals, but the kits remain relatively expensive and unfortunately, at present, testing costs more than a dose of vaccine.A negative test result indicates that the dog has little or no antibody, and that revaccination is recommended. Some seronegative dogs are in fact immune (false-negative) and their revaccination would be unnecessary because they would make a rapid and substantial anamnestic response to vaccination (Mouzin et al. 2004). However, such dogs cannot be detected readily and an animal with a negative result, regardless of the test used, should be considered as having no antibody and potentially susceptible to infection. In contrast, a positive test result would lead to the conclusion that revaccination is not required.Monitoring serum antibody specific for canine rabies is not generally used in the same manner for determining revaccination requirements as these are mandated by law. Laboratory testing for a protective rabies antibody titre (considered as more than 0 · 5 IU/ml) is required for international pet travel. Rabies serology is only performed by recognized reference laboratories.Serological testing for CDV, CAV and CPV-2 has application for determining protective immunity in the puppy, for informing revaccination intervals in adult dogs and in management of infectious disease outbreaks in shelters.A dedicated owner may wish to confirm that a puppy is protected after the course of primary vaccinations when these are completed at 16 weeks or older (Figure 1). A serum sample taken at least 4 weeks after the final vaccination may be tested. This interval will ensure that MDA is no longer present and that even 'slow responder' puppies have seroconverted. A seropositive puppy would not require a 26 or 52 week booster and could next receive core vaccine 3 years later. Seronegative puppies should be revaccinated and retested. If the pup 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 recognized the vaccinal antigen. Vaccines may fail to induce protective immunity in a puppy for various reasons: (1) MDA neutralizes the vaccine virus This is the most common reason for vaccination failure. However, when the last vaccine dose is given 16 weeks of age or older, MDA should have decreased to a low level (Friedrich & Truyen 2000) [EB1], and active immunization will succeed in most puppies. (2) The vaccine is poorly immunogenic Poor immunogenicity may reflect a range of factors from the stage of vaccine design and 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. In reality, such effects rarely affect vaccines produced by large, well-established manufacturers that market their vaccines internationally. These manufacturers have strict requirements from government regulatory agencies for batch potency testing before release. 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. The VGG has recognized that such 'vaccine husbandry' remains an issue in many countries and has included some simple guidelines in Table 6.Vaccine Husbandry: Key Points for Veterinary Practitioners Vaccines have an optimum storage temperature that is usually between 2–8 °C (domestic refrigerators should be maintained at 4 °C). These products should not be frozen or positioned adjacent to the freezer compartment of the refrigerator, and refrigerator temperature should be monitored regularly. Vaccines transported into the field should also be subject to continuation of the 'cold chain'.Freeze-dried vaccines should be reconstituted immediately before use with appropriate diluent or liquid vaccine given simultaneously (as per manufacturer's recommendations). It is bad practice and contraindicated to make up the vaccines anticipated to be used during the day first thing in the morning. Some vaccine components (e.g. CDV, FHV-1) are particularly labile in this regard and so these vaccines may not induce adequate immunity if not reconstituted just before use.Vaccines should only be mixed together in the same syringe if this is specified as acceptable in the manufacturer's data sheets.Syringes and needles for vaccines should not be re-utilized.Vaccine injection sites should not be sterilized with alcohol or other disinfectant as this may inactivate infectious (MLV) vaccines.Vaccines should be 'in date' and precise details of batch numbers, components and site of injection should be noted in the animal's medical record. (3) The animal is a poor responder (its immune system intrinsically fails to recognize the vaccinal antigens) If an animal fails to develop an antibody response after repeated revaccination, it should be considered a genetic non-responder. Because immunological non-responsiveness is genetically controlled in other species, certain breeds of dogs have been suspected to be poor-responders. It is believed (but unproven) that the high susceptibility to CPV-2 recognized in certain Rottweilers and Dobermanns during the 1980s (regardless of their vaccination history) relates in part to a high prevalence of non-responders (Houston et al. 1994) [EB4]. In the USA today, these two breeds seem to have no greater numbers of non-responders to CPV-2 than other breeds, possibly because carriers of the genetic trait may have died from CPV-2 infection. Some dogs of these breeds may be low or non-responders to other antigens. For example, in the UK and Germany, the non-responder phenotype remains prevalent amongst Rottweilers [EB3] for CPV-2 and recent studies have shown this breed to have a higher proportion of animals failing to achieve the titre of rabies antibody required for pet travel (Kennedy et al. 2007) [EB1]. Some broad estimates have been made of the proportion of genetic non-responders in the canine population, these being: 1 in every 5,000 dogs for CDV, 1 in every 100,000 dogs for CAV and 1 in every 1,000 dogs for CPV-2 [EB4].Antibody tests can be used to demonstrate the DOI after vaccination with core vaccines. It is known that a large majority of dogs maintain protective antibody against CDV, CPV-2, CAV-1 and CAV-2 for many years and numerous experimental studies support this observation (Bohm et al. 2004, Mouzin et al. 2004, Schultz 2006, Mitchell et al. 2012) [EB1]. Therefore, when antibody is absent (irrespective of the serological test used) the dog should be revaccinated unless there is a medical reason for not so doing, even though some will be protected by immunological memory.Antibody determinations to other vaccine components are of limited or no value because of the short time period these antibodies persist (e.g. Leptospira products) or the lack of correlation between serum antibody and protection (e.g. Leptospira and canine parainfluenza) (Hartman et al. 1984, Klaasen et al. 2003, Ellis & Krakowka 2012, Martin et al. 2014) [EB1].The VGG recognizes that at present such serological testing might be relatively expensive. However, the principles of 'evidence-based veterinary medicine' suggest that testing for antibody status (for either puppies or adult dogs) should be better practice than simply administering a vaccine booster on the basis that this would be 'safe and cost less'.While vaccination (i.e. active immunization) dominates infectious disease prevention, passive immunization continues to be used in the treatment of infectious disease in many countries.Although virus infections trigger both cellular and humoral immunity, it is mainly the antibody response that contributes to the reduction of viral load and recovery. In many virus infections, antibody levels are therefore taken as correlates of protection. During viraemia, pre-existing or injected antibodies directed against surface structures of virions bind to the particles, neutralize their infectivity and prepare them for removal. Therapeutically, most serum or immunoglobulin preparations used in passive immunization are injected subcutaneously (because they are from a different animal species) and quickly reach the circulation. Not unexpectedly, intravenous infusions of plasma or serum (from the same species) have been found to work as well. In local infections, such as those initiated by the bite of a rabid carnivore, post-exposure antibody prophylaxis has also proven invaluable in human medicine. Human rabies immune globulin provides rapid protection when given on the first day of the post-exposure prophylaxis regimen. As much as possible of the preparation is infiltrated into and around the wound, and may be given intramuscularly at a site distant from the rabies vaccine, which is applied simultaneously.In companion animal practice, preventive active immunization is so commonplace that serum prophylaxis/therapy is considered only under exceptional circumstances (e.g. when a dog is presented with distemper or a cat is presented with panleukopenia, or during a disease outbreak in a kennel/cattery). There is still a market for serum and immunoglobulin products, and companies producing them exist in the USA, Germany, the Czech Republic, Slovakia, Russia and Brazil. The preparations are either of homologous or heterologous (e.g. horse) origin, are polyvalent (directed against several viruses) and consist of sera or their immunoglobulin fraction.Despite the availability of such products, the VGG recommends that they be used conservatively, and only after careful consideration. In the case of an outbreak of CDV infection in a kennel, it is much safer and more effective to vaccinate all dogs with CDV vaccine rather than give immune serum (see below and Table 7) (Larson & Schultz 2006) [EB1]. In such a situation it has previously been recommended that MLV vaccines be administered intravenously (off-label) rather than subcutaneously or intramuscularly, but there is little evidence that this practice provides more effective or rapid protection than subcutaneous or intramuscular injection. Administration of CDV vaccines by any of those routes will provide protection from severe disease and death immediately or very shortly after vaccination. In this instance the vaccine does not prevent infection, but instead it protects from severe disease (especially from neurological disease) so the animal will survive and will subsequently be immune for life.Use of Serological Testing in a Shelter Infectious Disease OutbreakSituationSerological StatusRecommendation for AnimalsDisease outbreak within a shelter: all animals within the shelter should be tested serologically (i.e. for CDV, CPV2 and FPV outbreaks)Seropositive animals These are protected and will not become infected or die. These should be separated from the non- or low-responder animals. Seronegative animals These should be separated from the seropositive animals. These animals are susceptible and should not be adopted out of the shelter until after the incubation period for the infection (i.e. at least 2 weeks for CPV, at least 6 weeks for CDV). These animals should be vaccinated and retested to confirm seropositivity after the incubation periods above. Animals outside of a shelter needing to be admitted in the face of a disease outbreak in the shelterSeropositive animalsThese may safely enter the shelter as they are protected from disease.Seronegative animalsThese animals should be vaccinated and sent to foster homes until after they have seroconverted. They should not be allowed to enter the shelter until they are seropositive.In the case of a cattery outbreak of FPV infection, or a kennel outbreak of CPV-2 infection, a recent study has shown that if immune plasma is given after clinical signs appear, there is no benefit in reduction of morbidity or mortality (Bragg et al. 2012) [EB1]. However, this work has been criticised because only a small volume (12 ml) of immune plasma was given to each puppy in this study. Much larger volumes (6 · 6–11 ml/kg) are routinely used by researchers and practitioners and these large doses are believed by some experienced clinicians and investigators to have efficacy (Dodds 2012) [EB4]. In order to have a maximal beneficial effect, immune serum or plasma must be given after infection, but prior to the onset of clinical signs. In this case administration of immune serum or plasma is best provided within 24–48 hours after infection and a large amount of high titred serum or plasma is required. The serum or plasma must be given parenterally (e.g. subcutaneously, intravenously or intraperitoneally) and not orally. There is no benefit from oral administration even when treatment is started prior to infection.An important consideration in a shelter situation is the relative cost of these commercial products. An alternative practice that is sometimes used in a shelter situation is to collect serum or plasma from animals in the shelter that have survived disease or have been recently vaccinated. However, this practice carries risk as the serum will not necessarily have been screened for transmissible pathogens (e.g. haemoparasites or feline retroviruses). Serological testing provides a more effective approach to controlling disease outbreaks in a shelter situation (see below and Table 7).Since publication of the 2010 WSAVA guidelines, newly introduced vaccines include a Bordetella bronchiseptica vaccine for oral administration (Hess et al. 2011, Ellis 2015) and, globally, an increased range of Leptospira vaccines containing multiple, geographically relevant serogroups (Klaasen et al. 2012, 2014, Wilson et al. 2013, Schuller et al. 2015). These products are described in Table 1.A vaccine against canine influenza virus (CIV) infection is licensed only in the USA (Deshpande et al. 2009, Larson et al. 2011). The influenza A subtype H3N8 has been well recognized as a cause of respiratory disease in North American dogs that are housed together (Crawford et al. 2005, Payungporn et al. 2008, Castleman et al. 2010), but to date only sporadic outbreaks have been recognized and reported elsewhere (Crawford et al. 2005, Daly et al. 2008, Kirkland et al. 2010, Pratelli & Colao 2014, Schulz et al. 2014). The CIV vaccine contains inactivated virus and is administered to pups from 6 weeks of age with a second dose 2–4 weeks later and then annual revaccination. Immunity develops approximately 7 days after the second dose. The vaccine is considered non-core and is recommended only for at-risk dogs in North America that are likely to be exposed as part of their lifestyle (Anderson et al. 2013) [EB1]. At the time of writing, a local outbreak of canine influenza attributed to virus of the H3N2 subtype was reported from the Chicago and Wisconsin region of the USA and a conditionally licensed vaccine against this subtype has been released.The first canine immunotherapeutic vaccine for malignant melanoma was licensed in 2010. This product comprises the human tyrosinase gene incorporated into a plasmid (a 'naked DNA' vaccine) that is repeatedly delivered by use of a high-pressure transdermal injection device. The vaccine is used as an adjunctive treatment in dogs with oral melanomas and induces an immune response to this melanoma target antigen. Initial studies showed that the median survival time of dogs with grade II–IV melanoma increased to 389 days (from an expected survival of 90 days) (Bergman et al. 2006), but more recent studies have shown a lesser effect (Grosenbaugh et al. 2011, Ottnod et al. 2013) [EB1]. The vaccine is also available in Europe and, as in the USA, is limited to use by recognized veterinary oncology specialists.Two licensed vaccines for canine leishmaniosis were until recently available in Brazil, where leishmaniosis is a disease of major importance to the canine and human populations. The first of these is a subunit product containing GP63 of Leishmania donovani (also known as the 'fucose mannose ligand'; FML) in saponin adjuvant. It is considered to induce antibody that blocks the transmission of the organism from the dog to the sandfly vector by preventing binding of Leishmania to the midgut of the sand fly and has been extensively evaluated in immunological and epidemiological field studies (Palatnik de Sousa et al. 2009; Palatnik de Sousa & Day 2011) [EB1]. However, this product has been recently withdrawn from the Brazilian market. The second Brazilian vaccine contains the A2 antigen from L. donovani in saponin adjuvant. This vaccine is reported to induce similar protective effects in vaccinated dogs (i.e. with respect to seroconversion, prevention of infection and clinical signs and transmission to the vector) to the FML vaccine, when both were compared in a natural exposure field trial in an endemic area over an 11 month period. Dogs vaccinated with the A2 vaccine developed a lesser humoral immune response but showed a greater frequency of adverse events post vaccination (Fernandes et al. 2014).A European Leishmania vaccine for dogs was introduced in 2011 (Bongiorno et al. 2013; Moreno et al. 2013). This vaccine contains excretory–secretory antigens of Leishmania infantum in adjuvant. The vaccine is used in seronegative dogs from 6 months of age as three primary doses administered 3 weeks apart with an annual booster. Vaccinated dogs will seroconvert, but the product datasheet describes a discriminatory serological test. Evidence for a cell-mediated immune response is also suggested. The vaccine claims to reduce the likelihood of infection and reduce the severity of clinical signs in infected dogs, but makes no public health claim for an effect on human disease prevalence [EB2].Guidelines and recommendations for core (recommended), non-core (optional) and not recommended vaccines for cats visiting the general veterinary practice are given in Table 3. The core vaccines for the cat are those that protect against feline panleukopenia (FPV), FHV-1 and FCV. 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, the VGG recommends that 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 (although this does not always include cats) and rabies vaccination is also required for international pet travel.WSAVA Feline Vaccination GuidelinesVaccineInitial kitten vaccinationInitial adult vaccinationRevaccination recommendationComments Feline Parvovirus (FPV; MLV, parenteral) FPV (killed, adjuvanted or killed, non-adjuvanted, parenteral) FPV (MLV, non-adjuvanted, intranasal) Begin at 6–8 weeks of age, then every 2–4 weeks until 16 weeks of age or older [EB1].Two doses 2–4 weeks apart are generally recommended by manufacturers, but one dose of MLV vaccine is considered protective [EB4].Revaccination (booster) at either 6 months or 1 year of age, then not more often than every 3 years.Core. Vaccination of queens should occur before and not during pregnancy. Should vaccination during pregnancy be essential, only killed core vaccines should be used. MLV vaccines must not be used in pregnant animals. MLV vaccines should not be used in FeLV- and/or FIV-infected cats [EB4]. Feline Herpesvirus-1 (FHV-1; MLV, non-adjuvanted, parenteral and intranasal products are available) FHV-1 (killed, adjuvanted, parenteral) Begin at 6–8 weeks of age, then every 2–4 weeks until 16 weeks of age or older [EB1].Two doses 2–4 weeks apart are generally recommended.Revaccination (booster) at either 6 months or 1 year of age, then not more often than every 3 years for a low-risk cat [EB1]. Annual revaccination should be provided for a higher risk cat. Core. MLV FHV-1/FCV vaccines are invariably combined with each other, either as bivalent products or in combination with additional vaccine antigens (e.g. FPV). Mild upper respiratory disease signs are occasionally seen following intranasal vaccination or aerosolization or leakage from the injection site of parenteral MLV vaccine. Note: for definition of low and higher risk cat refer to text. Feline Calicivirus (FCV; MLV, non-adjuvanted, parenteral and intranasal products are available) FCV (killed, non-adjuvanted parenteral; containing two strains of calicivirus) FCV (killed, adjuvanted, parenteral) Begin at 6–8 weeks of age, then every 2–4 weeks until 16 weeks of age or older [EB1].Two doses 2–4 weeks apart are generally recommended.Revaccination (booster) at either 6 months or 1 year of age, then not more often than every 3 years for a low-risk cat [EB1]. Annual revaccination should be provided for a higher-risk cat. Core. MLV FHV-1/FCV vaccines are invariably combined with each other, either as bivalent products or in combination with additional vaccine antigens (e.g. FPV). Mild upper respiratory disease signs are occasionally seen following intranasal vaccination or aerosolization or leakage from the injection site of parenteral MLV vaccine. Transient polyarthritis is occasionally reported after FCV vaccination. Note: for definition of low and higher-risk cat refer to text. Rabies (canary pox virus-vectored recombinant, non-adjuvanted, parenteral) Administer a single dose as early as 12 weeks of age, with revaccination 1 year later.Administer a single dose with revaccination at 1 year of age.Revaccination (booster) as per licensed DOI or as required by local regulations.Core in areas where the disease is endemic. Rabies (1- and 3-year killed, adjuvanted products are available, parenteral) Administer a single dose as early as 12 weeks of age, with revaccination 1 year later.Administer a single dose with revaccination 1 year later.Revaccination (booster) as per licensed DOI or as required by local regulations.Core in areas where the disease is endemic.Feline Leukemia Virus (FeLV; canary pox virus-vectored recombinant, non-adjuvanted, injectable)Administer an initial dose as early as 8 weeks of age; a second dose must be administered 3–4 weeks later.Two doses, 3–4 weeks apartA single dose 1 year following the last dose of the initial series, then not more often than every 2–3 years in cats determined to have sustained risk of exposure [EB4].Non-Core. Only FeLV-negative cats should be vaccinated. FeLV testing must be performed prior to vaccine administration to avoid unnecessary administration of vaccine. FeLV (killed, adjuvanted, parenteral) FeLV (recombinant protein subunit, adjuvanted, parenteral) Administer an initial dose as early as 8 weeks of age; a second dose must be administered 3–4 weeks later.Two doses, 3–4 weeks apartA single dose 1 year following the last dose of the initial series, then not more often than every 2–3 years in cats determined to have sustained risk of exposure [EB4].Non-Core. Only FeLV-negative cats should be vaccinated. FeLV testing must be performed prior to vaccine administrationFeline Immunodeficiency Virus (FIV; killed, adjuvanted, parenteral) Three doses are required. The initial dose is administered as early as 8 weeks of age; two subsequent doses should be administered at an interval of 2–3 weeks. Three doses are required. Each dose is administered 2–3 weeks apart. A single dose 1 year following the last dose of the initial series, then annually in cats determined to have sustained risk of exposure.Non-core. Vaccination induces production of antibodies indistinguishable from those developed in response to FIV infection as detected by in-practice test kits. Some discriminatory serological tests have been reported. Validated PCR diagnostics are becoming more widely available and are recommended by the VGG. Chlamydia felis (avirulent live, non-adjuvanted, parenteral) Chlamydia felis (killed, adjuvanted, parenteral) Administer the initial dose as early as 9 weeks of age; a second dose is administered 2–4 weeks later.Administer two doses, 2–4 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 animals in multicat environments where infections associated with clinical disease have been confirmed. Inadvertent conjunctival inoculation of vaccine has been reported to cause clinical signs of infection. Bordetella bronchiseptica (avirulent live, non-adjuvanted, intranasal) Administer a single dose intranasally as early as 4 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; for example, cats that are kept in large colonies. 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.Two doses 3–4 weeks apart.Annual booster is recommended by the manufacturer.Not Recommended. According to the limited studies available, only cats known to be feline coronavirus antibody-negative at the time of vaccination are likely to develop some level of protection. It is rare that a cat will be coronavirus antibody negative at 16 weeks of age or older.In terms of feline core vaccines it is important to realize that the protection afforded by the FCV and FHV-1 vaccines will not match the immunity provided by FPV vaccines. Thus the feline core respiratory disease vaccines should not be expected to give the same robust protection, nor the duration of immunity, that is seen with canine core vaccines. FCV vaccines have been designed to produce cross-protective immunity against multiple strains of FCV; however, it is still possible for infection and disease to occur in vaccinated adult animals (Pedersen et al. 2000, Schorr-Evans et al. 2003) [EB1]. There is no FHV-1 vaccine that can protect against infection with virulent virus and infection may lead to the virulent virus becoming latent with the possibility of reactivation during periods of severe stress (Richter et al. 2009, Maes 2012) [EB1]. The reactivated virus may cause clinical signs in the vaccinated animal or the virus can be shed to susceptible animals and cause disease in them. The VGG recommends triennial revaccination of low-risk cats for FHV-1 and FCV on the basis of a published study showing a minimum duration of partial, but clinically significant, immunity of 7.5 years for these core vaccines (Scott & Geissinger 1999). A more recent study of a MLV FHV-1/FCV vaccine seemed to show much less substantial, partial protection against FHV-1 at 3 years post vaccination; although the FCV partial protection was comparable to that shown by Scott and Geissinger in1999 (Jas et al. 2015). [EB1]. The VGG recommends that annual revaccination of cats against FHV-1/FCV be carried out in higher-risk situations. A low-risk cat might be defined as a solitary, indoor animal that does not visit a boarding cattery. A higher-risk cat might be defined as an animal that regularly visits a boarding cattery or that lives in a multicat, indoor–outdoor household. Moreover, the VGG encourages practitioners to consider the timing of administration of FHV-1/FCV vaccines to higher-risk, regularly boarding cats. The most robust immunity conferred by these vaccines occurs within the 3-month period after vaccination (Gaskell et al. 2007) [EB1], and so administration of these vaccines might best be timed for immediately before a regularly boarded cat is due to make an annual visit to the cattery.Vaccination against feline leukaemia virus (FeLV) is also often a point of debate amongst experts. The VGG regards FeLV as a non-core vaccine (Table 3), but fully appreciates that use of this product must be determined by the lifestyle and perceived exposure risk of individual cats and the prevalence of infection in the local environment. Many feline experts believe that even though the prevalence of FeLV infection is now markedly reduced in many parts of the world due to successful control programmes (Weijer and Daams 1976, Weijer et al. 1986,1989, Meichner et al. 2012) [EB1], in geographical areas in which FeLV infection remains prevalent, any cat less than 1 year old with an element of outdoor lifestyle (e.g. even living with a cat that goes outdoors) should receive the benefit of protection by routine vaccination with two doses of vaccine given 2–4 weeks apart starting not earlier than 8 weeks of age. This 'risk-benefit' analysis for FeLV should form a routine part of the feline vaccination interview and only FeLV-negative cats should be vaccinated.The VGG has also reconsidered the FIV vaccine, which in previous iterations of these guidelines has been categorized as 'not recommended'. The basis for this categorization was: (1) questions over the cross-protection between subtypes of virus included in the vaccine and those subtypes and recombinants in the field in different geographical areas (Hosie et al. 1995, Dunham et al. 2006, Yamamoto et al. 2007, Coleman et al. 2014, Beczkowski et al. 2015a) [EB1], (2) the interference of the vaccine with antibody testing used for diagnosis of FIV infection (Hosie & Beatty 2007) [EB1], and (3) the fact that this is an adjuvanted vaccine that must be given repeatedly (a primary course of three injections and annual revaccination) to a species susceptible to injection site sarcoma. The VGG is aware that in some parts of the world, there remains a significant prevalence of FIV seropositivity and/or infection (Bennett et al. 1989, Hosie et al. 1989, Friend et al. 1990, Glennon et al. 1991, Bandecchi et al. 1992, Hitt et al. 1992, Ueland and Lutz 1992, Jones et al. 1995, Hofmann-Lehmann et al. 1996, Yilmaz et al. 2000, Lee et al. 2002, Muirden 2002, Norris et al. 2007, Gleich et al. 2009, Ravi et al. 2010, Bande et al. 2012, Chang Fung Martel et al. 2013, Rypula et al. 2014) [EB1]. There are now discriminatory serological tests (Kusuhara et al. 2007, Levy et al. 2008, Westman et al. 2015) and more robust polymerase chain reaction (PCR) testing for the diagnosis of FIV infection (Arjona et al. 2007, Wang et al. 2010, Morton et al. 2012) [EB1]. In many countries, it is most unlikely that cat owners will be persuaded to keep their cats indoors, away from the major risk of FIV transmission (bites by infected cats). Disease progression in FIV-infected cats has recently been shown to be impacted by housing conditions and number of cats in the household (Beczkowski et al. 2015b). Given that this vaccine has been shown to have efficacy in some studies, but not in others, and might benefit some at-risk populations of cats, the VGG has reclassified the product as a non-core vaccine.As discussed for puppies, 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 can respond immunologically to vaccination are unknown. This is related to the level of maternal antibody and variation in uptake of MDA between litters and individuals. In general, MDA will have waned by 8–12 weeks of age to a level that allows an active immunological response; 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. The VGG has reviewed recent studies suggesting that up to one third of kittens may fail to respond to a final core vaccine given at 16 weeks of age and that a proportion of kittens may still have blocking MDA at 20 weeks of age (DiGangi et al. 2012, Jakel et al. 2012). The VGG notes that one of these studies was of a relatively low number of animals, dominated by one breed, within a cattery setting, and suggests that the data may not be fully applicable to the wider feline population. Nevertheless, the VGG has increased the recommended age for the final vaccination in the series of primary core vaccinations from 14–16 weeks of age to 16 weeks or older [EB1].The VGG recommendation for the core vaccination of kittens is therefore in line with the schedules proposed for puppies above: beginning at 6–8 weeks of age and then repeating vaccination every 2–4 weeks until 16 weeks of age or older. Therefore the number of kitten primary core vaccinations will be determined by the age at which vaccination is started and the chosen revaccination interval. Possible schedules are outlined in Table 5. By this recommendation, when vaccination is started at 6 or 7 weeks of age, a course of four primary core vaccines would be administered, but only three would be required with an 8- or 9-week start.An integral part of core vaccination of kittens is the 'booster' vaccine that has traditionally been given either at 12 months of age or 12 months after the last of the primary series of kitten vaccines. The main aim of this vaccine is to ensure that a protective immune response develops in any cat that may have failed to respond to any of the three vaccines in the primary core series, rather than necessarily 'boosting' the immune response. The delivery of this vaccine at 12 months of age is likely to have been chosen historically as a convenient time to request the owner to attend the practice for a first annual health check. This therefore implies that should an individual kitten fail to respond to any of the three primary core vaccinations, that kitten may be unprotected until it receives this 12-month vaccine. This might account for occurrences of infectious disease in a proportion of vaccinated kittens at less than 12 months of age. The VGG has re-evaluated this practice and now suggests that

veterinarians might wish to reduce this possible window of susceptibility by bringing forward this vaccine from 52 weeks to 26 weeks of age (or indeed at any time point between 26 and 52 weeks of age; however, 26 weeks of age provides a convenient timing). This practice will require that pet owners clearly understand why this is recommended, because as indicated in Table 5, adopting such a protocol will mean that vaccination started in a 6 or 7 week old kitten, might now entail up to five vaccine visits in the first 6 months of life. For core vaccines, after a 26 week 'booster', another core vaccine would not be required for at least another 3 years (for a low-risk cat). As for puppies, adoption of the 26 week vaccination approach would not preclude a first annual health check at 12 or 16 months of age.Cats that have responded to vaccination with MLV core vaccines maintain a solid immunity (immunological memory) against FPV for many years in the absence of any repeat vaccination. Immunity against FCV and FHV-1 is only partial (Scott and Geissinger 1999, Jas et al. 2015). The VGG recommendation for adult 'low-risk' cats is for revaccination with MLV core vaccines at intervals of 3 years or longer. For 'higher-risk' cats (see definitions above) the veterinarian might consider administering FPV vaccine no more frequently than every 3 years, but giving FCV and FHV-1 vaccines annually, with these latter products timed for administration shortly before any regular annual visit to a boarding cattery [EB1]. These recommendations do not generally apply to killed core vaccines (except for rabies) nor to the non-core vaccines, and particularly not to vaccines containing bacterial antigens. Thus Chlamydia (formerly Chlamydophila; Sachse et al. 2015) and Bordetella products, if their use is deemed necessary, require annual boosters for the limited protection afforded by these products [EB2].Therefore, according to these guidelines, an adult cat may still receive an annual vaccination; however, the components of that vaccination may differ from year to year. Typically, core vaccines (especially FPV) are currently administered triennially with respiratory virus vaccines given according to risk and chosen non-core products being given annually. The VGG is aware that in some countries only multi-component products containing core and non-core combinations are available. The VGG would encourage manufacturers to make a full range of vaccines available wherever possible or, at the very least, make a core-only combination for those not wanting to give any of the non-core vaccines.An adult cat that received a complete course of vaccination for FPV, FHV-1 and FCV as a kitten (including the 6- or 12-month booster), but may not have been regularly vaccinated as an adult requires only a single dose of MLV core vaccine to boost immunity [EB4]. An adopted adult cat (or kitten over 16 weeks of age) of unknown vaccination history requires only a single dose of MLV FPV core vaccine to engender a protective immune response to that virus. In contrast, an adopted adult cat of unknown vaccination history should receive two doses of MLV FHV-1/FCV vaccine (2–4 weeks apart) to establish an adequate immune response [EB2].Vaccines (of any type) are one class of injectable product that has been linked to the pathogenesis of the feline injection site sarcoma (FISS) and particular attention has focused on the administration of adjuvanted FeLV and rabies vaccines (Kass et al. 1993). FISS has been the subject of much research and there are a number of recent reviews on the subject (Martano et al. 2011, Srivastav et al. 2012, Ladlow 2013, Hartmann et al. 2015). Although the pathogenesis of FISS remains unproven, current belief is that a localized chronic inflammatory reaction initiates malignant transformation of mesenchymal cells and that this process has some genetic basis. Most subcutaneous injections (including of vaccines) have traditionally been given into the interscapular region of the cat, which remains a common site for formation of a FISS. The infiltrative nature of these tumours means that radical surgical resection is often necessary to attempt removal of these lesions although adjunctive treatment modalities are also used (Martano et al. 2011, Ladlow 2013).In North America the response to this issue was the recommendation of a protocol whereby the two perceived high-risk adjuvanted vaccines would be administered into distinct anatomical sites that would be more amenable to surgical removal of any FISS that might develop. Accordingly the recommendation 'left leg leukaemia, right leg rabies' suggested that FeLV vaccine should be given as far distal as possible into the left hindlimb, whilst rabies vaccine should be given as far distal as possible into the right hindlimb. This recommendation remains in the current AAFP guidelines (Scherk et al. 2013), which also specify administration of the three feline core vaccines into a distal forelimb. One study evaluated the effect of this practice by comparing the anatomical distribution of FISS in cats before the recommendation was made (1990–1996) and after the practice was adopted (1997–2006) (Shaw et al. 2009). The data showed a significant decrease in the prevalence of interscapular FISS and an increase in prevalence of tumours in the right (but not left) forelimb. More notably, there was also an increase in the number of tumours reported arising in the combined regions of the right hindlimb with right lateral aspect of the abdomen (12.5% to 25.0%) and the left hindlimb with left lateral aspect of the abdomen (11.4% to 13.8%). This was attributed to the difficultly of injecting into the distal hindlimb and these abdominal sites being accidentally injected. This practice has not been widely adopted outside of North America.Recently, one publication has shown the efficacy of administering FPV and rabies vaccines into the tail of cats (Hendricks et al. 2014). Adult cats from a community trap–neuter–return programme were given trivalent MLV core vaccine (FPV, FHV-1, FCV) into the distal third of the dorsal tail with inactivated rabies vaccine administered 2 cm distal to the site of the trivalent vaccination. Seroconversion occurred in all cats to FPV and all but one cat for rabies virus. Tail vaccination was reported to be well tolerated by the cats in this small study. In the 2010 WSAVA vaccination guidelines, the VGG proposed the alternative of delivering vaccine into the skin of the lateral thorax, or better, the lateral abdomen (Day et al. 2010). Tail injection may prove to be a safer alternative than distal limb injections or lateral body wall injections, but further studies of tail vaccination will be required.This remains a confusing and contentious area and individual practitioners must decide for themselves which approach is practical for their own practice setting. However, the following principles should still be applied:Any risk of FISS is outweighed by the benefit of protective immunity conferred by vaccines. Current estimates of the prevalence of FISS are 1 in every 5,000 to 12,500 cats vaccinated (Gobar and Kass 2002, Dean et al. 2013).Non-adjuvanted vaccines should be administered to cats wherever possible.Vaccines (particularly adjuvanted products) or other injectables should not be administered into the interscapular region.Vaccines (particularly adjuvanted products) should be administered into other subcutaneous (and not intramuscular) sites. The choice of these sites should be based on a balance between the ease of surgical resection of any FISS that might develop and acceptable safety for the vaccinator (i.e. to avoid accidental self-injection during difficult restraint of the animal).Vaccines should be administered into a different site on each occasion. This site should be recorded in the patient's record or on the vaccination card by use of a diagram indicating which products were administered on any one occasion. The sites should be 'rotated' on each occasion. Alternatively, a practice might develop a group policy that all feline vaccinations are administered to a specific site during one calendar year and this site is then rotated during the following year.The VGG encourages all cases of suspected FISS to be notified via the appropriate national reporting route for suspected adverse reactions or to the vaccine manufacturer.Since the publication of the 2010 guidelines, one commercial in-practice rapid test for determination of serum antibody to FPV, FCV and FHV-1 has become available. This test has now been validated and applied in a series of published investigations (DiGangi et al. 2011, Mende et al. 2014) [EB1]. This test kit may be used for the determination of the presence of protective antibody against FPV as there is excellent correlation between the presence of such antibody and resistance to infection (Lappin et al. 2002) [EB1]. The FPV test kit is reported to have 89% specificity and 79% sensitivity (Mende et al. 2014) or 99% specificity and 49% sensitivity (DiGangi et al. 2011) when compared with a haemagglutination inhibition test. A negative test result indicates that a cat has little or no antibody, and that revaccination is recommended. However, some seronegative cats are in fact immune (false-negative) and their revaccination would be unnecessary. In contrast, a positive test result would lead to the conclusion that revaccination is not required.The correlation between circulating serum antibody and protection against FCV and FHV-1 infection is less robust than the presence of adequate local mucosal immunity and cell-mediated immunity, respectively. For that reason, a negative test result for FCV or FHV-1 antibody would not necessarily indicate lack of protection in a particular cat (Lappin et al. 2002) [EB1]. These tests can be applied in practice as described above for the dog: for determination of protection of kittens following FPV vaccination, for determination of protection against FPV in adult cats (in order to inform decisions about revaccination) and for use in the shelter situation in the control of outbreaks of FPV infection. It should be emphasized that antibody testing for FIV is used to diagnose disease and is of no value in determining immunity to FIV, but as discussed above, where FIV vaccine is used and FIV infection is suspected, diagnosis should be made using a discriminatory serological test or, preferably, a validated PCR test.An animal shelter is a holding facility for animals usually awaiting adoption, rescue or reclamation by owners. In general, animal shelters are characterized by a random source population with a mostly unknown vaccination history, high population turnover and high infectious disease risk. The term 'shelter' encompasses situations ranging from sanctuaries that possess a stable population, to facilities that admit hundreds of animals per day, to rescue and foster homes that care for multiple individuals or litters at any given time. Just as 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 clinicians have to practice in an environment where eradication of infectious disease cannot be attained. It is possible, however, to minimize the spread of infections within a high-density, high-risk population and maintain the health of not-yet-infected individuals. When the overall purpose is to place healthy pets into welcoming homes, the time and effort dedicated to controlling infectious disease is only one of many variables in the complex shelter medicine and husbandry equation. The recommendations provided here attempt to address some shelter-unique issues as they pertain to vaccination and disease control.Guidelines and recommendations for vaccines to be used in shelters are given in Tables 2 and 4. In these updated guidelines, we have standardized the recommendations for puppies and kittens entering a shelter to indicate that core vaccination may be started as early as 4–6 weeks of age, and (where funding permits) revaccination should be every 2 weeks until the animal reaches 20 weeks of age, if it remains in the shelter until that time [EB4]. Recent US studies have shown that cats entering shelters may be seropositive for vaccine-preventable infectious disease agents. DiGangi et al. (2012) reported seropositivity for FPV (60.2%), FHV-1 (89%) and FCV (63.4%) and Fischer et al. (2007) reported seropositivity for FPV (33%), FHV-1 (21%), FCV (64%) and rabies virus (3%). Seropositivity to CDV (41.2%) was less than for CPV (84.3%) in dogs entering one US shelter (Litster et al. 2012) and in another study 35.5% of dogs were seropositive to both CDV and CPV, 7.7% to CDV only, 31.5% to CPV only and 25.3% to neither virus (Lechner et al. 2010). If unambiguous documentation of vaccination is provided for an adult animal at the time of admission to a shelter, there is no reason to revaccinate with canine core vaccines, but feline core vaccines, specifically FCV and FHV-1, may be of value in boosting immunity.WSAVA Guidelines on Canine Vaccination for the Shelter EnvironmentRecommended Vaccines in Various Combinations (also refer to Table 1)Initial Vaccine Series for PuppiesInitial Vaccine Series for AdultsComments CDV + CAV-2 + CPV-2 (MLV) with or without CPiV rCDV + CAV-2 + CPV-2 with or without CPiV Parenteral Administer one dose prior to or immediately on admission, as early as 4 weeks of age. Repeat at 2 week intervals until 20 weeks of age if animal is still in the facility.Administer one dose prior to or immediately on admission. Repeat in 2 weeks. Ideally puppies should be vaccinated beginning at 6 weeks of age. In the face of an outbreak, vaccination as early as 4 weeks of age (for CDV and/or CPV-2) may be indicated. MDA, if present, can interfere with immunization, but nursing history is often not available. Bordetella bronchiseptica (live avirulent bacteria, intranasal) B. bronchiseptica + CPiV (MLV) intranasal B. bronchiseptica + CPiV (MLV) + CAV-2 (MLV) intranasal B. bronchiseptica (live avirulent bacteria, oral) 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 [EB4].Two doses 2 weeks apart are recommended. A single dose may be protective, but in this high-risk situation a second dose might provide greater protection [EB4].Intranasal or oral vaccine is strongly recommended in the shelter situation. Intranasal or oral vaccines MUST NOT be administered parenterally as this may lead to severe adverse reactions or death. Bordetella bronchiseptica (bacterin or antigen extract for parenteral administration only)Administer one dose at time of admission (from 6–8 weeks of age) and a second dose 2 weeks later.Two doses 2 weeks apart are recommended. Parenteral vaccination is recommended only when it is not possible to administer an intranasal or oral vaccine. Canine respiratory disease complex ('kennel cough') is not a vaccine-preventable disease and the vaccine should only be used to help manage the disease. RabiesA single dose should be administered at the time of discharge from the facility.A single dose should be administered at the time of discharge from the facility.The administration of rabies vaccine will be determined by whether the shelter is in a country in which the disease is endemic, and by local statute.WSAVA Guidelines on Feline Vaccination for the Shelter EnvironmentVaccineKittensAdultComments FPV FHV-1 FCV Administer a single dose prior to or at the time of admission as early as 4–6 weeks of age; then, every 2 weeks until 20 weeks of age if still in the facility.Administer a single dose at the time of admission; repeat in 2 weeks if the animal remains in the shelter. MLV preparations are preferable. Use of intranasal FPV vaccines is not recommended in the shelter environment (Schultz 2009). 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 is impossible to distinguish from active infection. RabiesA single dose should be administered at the time of discharge from the facility.A single dose should be administered at the time of discharge from the facility.The administration of rabies vaccine will be determined by whether the shelter is in a country in which the disease is endemic and vaccination is required by law.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. In dogs, the use of non-core vaccines against respiratory infections is also appropriate under these circumstances. The VGG is aware that in some countries vaccination protocols for animals entering a boarding kennel/cattery are formulated by local authorities and may be contrary to current guidelines (e.g. insistence on annual revaccination). The VGG encourages such authorities to reconsider these recommendations in light of current scientific thinking and product availability and encourages the veterinary profession and national associations to lobby for such change.Since publication of the 2010 guidelines, the availability of rapid in-house serological test kits has had major impact on the management of outbreaks of CDV, CPV or FPV in animal shelters [EB3]. The approach to use of these kits in such situations is outlined in Table 7.In the past, veterinary practice has benefited from the annual administration of vaccines. By encouraging owners to bring their pets yearly for vaccination, veterinarians were able to recognize and treat disease earlier than might otherwise have been the case. In addition, the annual visit provided an opportunity to inform clients of important aspects of canine and feline health care.Unfortunately, many clients have come to believe that vaccination is the most important reason for annual veterinary visits. Veterinarians have been concerned that a reduction in vaccination frequency will cause clients to forgo the annual visits and that the quality of care will diminish. It is therefore essential that veterinarians stress the importance of all aspects of a comprehensive individualized health care program. Emphasis should be placed on detailed history taking; thorough physical examination performed in the presence of the client, and individualized patient care. The importance of dental care, proper nutrition, appropriate diagnostic testing and the control of parasites and of zoonotic diseases should be addressed during evaluation of each pet. Behavioural concerns should be discussed, as well as the necessity for more frequent, tailored examination of young and geriatric animals and animals of particular breeds with well characterized disease predispositions. Discussion of vaccination is simply one part of the annual health check visit.During regular (usually annual) health checks, clinicians should assess the need for core and non-core vaccines for that particular year. 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. While an animal might not receive core vaccination every year, most non-core vaccines require annual administration – so owners will continue to see their animal vaccinated annually. The regional incidence and risk factors for various infectious diseases should also be discussed. Ways to reduce the impact of acquired disease (e.g. avoiding overcrowding, improving nutrition, and restricting access to infected animals) should also be reviewed.Vaccinations should be considered as only one component of a comprehensive preventive health care plan individualized based on the age, breed, health status, environment (potential exposure to harmful agents), lifestyle (contact with other animals) and travel habits of the pet.Age has a significant effect on the preventive health care needs of any given individual. Puppy/kitten programs have traditionally focused on vaccinations, parasite control and neutering. Today, opportunity exists to incorporate behaviour counselling and zoonotic disease management. For the ageing pet, senior care programs are becoming increasingly popular. Nutritional, dental disease and parasite control assessment and counselling should take place on an individualized basis throughout the life of the pet. There is no evidence that older dogs and cats, which have been fully vaccinated as pups or kittens, require a specialized programme of core vaccination (Day 2010, Horzinek 2010, Schultz et al. 2010). Experimental evidence shows that older dogs and cats have persisting immunological memory to core vaccines, as detected by measurement of serum antibody, and that this may be readily boosted by administration of a single vaccine dose (Day 2010) [EB1]. In adult animals, decisions about revaccination with most core products (CDV, CAV and CPV and FPV) may be made via serological testing. Practitioners who offer this alternative to vaccination report that it is greatly appreciated by owners who may have concerns about vaccination frequency and offering this alternative acts as a 'practice builder'. By contrast, aged animals may not be as efficient at mounting primary immune responses to novel antigens that they have not previously encountered (Day 2010) [EB1]. Studies of UK dogs and cats vaccinated for the first time against rabies for pet travel have clearly shown that more aged animals fail to achieve the legally required antibody titre (Kennedy et al. 2007) [EB1].The environment in which a pet resides can profoundly affect its health status and should be assessed during annual health care visits in order to define risk factors and develop appropriate preventive measures.By estimating 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 where the animal normally lives. Determining past and anticipated future travel during each visit allows for greater individualization of preventive care and diagnostic testing plans.At the time of vaccine administration, the following information should be recorded in the patient's permanent medical record:date of vaccine administrationidentity (name, initials or code) of the person administering the vaccinevaccine name, lot or serial number, expiry date and manufacturersite and route of vaccine administration.The use of peel-off vaccine labels and stamps that imprint the medical record with the outline of a pet facilitates this type of record keeping which is mandatory in some countries. Adverse events should be recorded in a manner that will alert all staff members during future visits. Informed consent should be documented in the medical record in order to demonstrate that relevant information was provided to the client and that the client authorized the procedure (e.g. 'off-label' use of products as discussed above). At the very least, this notation should indicate that a discussion of risks and benefits took place prior to vaccination.VGG recommends that vaccination certificates be designed to include not just the dates on which vaccines were administered, but also a field for the veterinarian to state the date on which vaccination is next recommended. This will help diminish confusion in the minds of pet owners and kennel/cattery proprietors.Adverse events are defined as any side effects or unintended consequences (including lack of protection) associated with the administration of a vaccine product. They include any injury, toxicity or hypersensitivity reaction associated with vaccination, whether or not the event can be directly attributed to the vaccine. Adverse events should be reported, whether their association with vaccination is recognized or only suspected. A vaccine adverse event report should identify the product(s) and animal(s) involved in the event(s) and the individual submitting the report.Reporting field observations of unexpected vaccine performance is the most important means by which the manufacturer and the regulatory agency are alerted to potential vaccine safety or efficacy problems that may warrant further investigation. The purpose of pre-licensure safety studies is to detect relatively common adverse events. Rare or delayed adverse events will be detected only by post-marketing surveillance through analysis of reported adverse events. Adverse events should be reported to the manufacturer and/or the local regulatory authority. In many countries governmental surveillance schemes are not available and reactions should therefore be notified to the manufacturer. The VGG recognizes that there is gross under-reporting of vaccine-associated adverse events, because of the passive nature of reporting schemes, which impedes knowledge of the ongoing safety of these products [EB4]. The VGG would actively encourage all veterinarians to participate in such surveillance schemes.If a particular adverse event is well documented, reporting serves to provide a baseline against which future reports can be compared. In addition, reported adverse events can lead to detection of previously unrecognized reactions, detection of increases in known reactions, recognition of risk factors associated with reactions, identification of vaccine lots with unusual events or higher numbers of adverse events, and can further stimulate clinical, epidemiological or laboratory studies. Therefore, veterinarians are encouraged to report any clinically significant adverse event occurring during or after administration of any licensed vaccine. Reporting a vaccine adverse event is not an indictment against a particular vaccine; it facilitates review of temporally associated conditions and adds to the safety database of the product.Types of Vaccines Available Modified Live Virus (MLV) Vaccines: There are three contemporary variants of CPV-2, which are referred to as CPV-2a, CPV-2b and CPV-2c. The original CPV-2 variant is rarely isolated nowadays, although it is still present in some modified live vaccines and can be shed from vaccine recipients. The most recent variant to emerge is CPV-2c and this genotype is recognized in North and South America, Europe, Africa and Asia (Ohneiser et al. 2015). All genotypes are antigenically related; challenge studies have shown that vaccination of dogs with current CPV vaccines containing either CPV-2 or CPV-2b will provide protective immunity against all the other variants, including CPV-2c (Spibey et al. 2008, Decaro & Buonavoglia 2012, Wilson et al. 2013). Conversely, there is one report of an outbreak of CPV-2c infection in vaccinated adult dogs (Decaro et al. 2008). These dogs had been vaccinated at 42, 57 and 90 days of age and the adults had received annual boosters. 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 with the MLV vaccines (Pollock & Carmichael 1982b). They are not recommended for routine use. Killed vaccines may provide some benefit in wild and exotic species or pregnant bitches, where some 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) DOI after natural infection/disease is thought to be life-long in the majority of dogs.DOI after vaccination with MLV vaccines is 9 years or longer, based on challenge and serological studies (Schultz et al. 2010).DOI after vaccination with killed vaccines is 3 years or longer.MDA interferes with active immunization for varying periods of time in the puppy, depending on the titre of colostral antibody and the amount of antibody absorbed after birth, as well as the specific vaccine (Pollock & Carmichael 1982a).The 'window of susceptibility' is defined as the period of time during which a pup can be infected by field virus, but vaccines cannot immunize. For highly effective MLV vaccines (i.e. high titre, low passage) the 'window of susceptibility' is as short as 2 weeks or less, while for less effective MLV vaccines, the window of susceptibility is as long as 10–12 weeks (Schultz & Larson, 1996, Hoare et al. 1997).After completing the puppy series at 16 weeks or older and vaccinating again at 26 or 52 months of age, revaccination need not be done more often than every 3 years.In the absence of MDA, MLV vaccines provide immunity as early as 3 days after vaccination (Schultz & Larson 1996).The presence of serum antibody, regardless of titre, in an actively immunized dog over the age of 20 weeks is correlated with protection.Precautions MLV vaccines should not be used in wildlife species.MLV vaccines should not be used in pregnant bitches unless specifically indicated.Puppies younger than 4–6 weeks of age should not be vaccinated with MLV products.Disease Facts After infection, it takes 3–7 days 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, the virus can remain infectious for 1 year or more. Therefore, all facilities where infected animals have been present must be considered infected.A positive faecal antigen detection test result in a puppy with clinical signs suggestive of canine parvoviral enteritis will not have been caused by any recent CPV vaccine the animal may have received (DeCaro et al. 2014).Types of Vaccines Available 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' (Curtis & Barnett, 1983). In addition to parenteral MLV CAV-2 vaccine preparations there are combination or monovalent products to protect against the canine infectious respiratory disease complex (CIRDC), which includes Bordetella bronchiseptica and canine parainfluenza virus (CPiV) and CAV-2. The intranasal product that contains CAV-2, CPiV and Bordetella can be used to decrease the severity of CIRDC, but should not be used as the only vaccine to prevent ICH; for this purpose, the parenteral MLV-CAV-2 should also be given. Inactivated (Killed) Vaccines: Inactivated (killed) CAV-1 and CAV-2 vaccines are sold in some countries, but they are not recommended when MLV products are available, as they are less effective.Mechanisms and Duration of Immunity (DOI) DOI after naturally-acquired canine infectious hepatitis is thought to be life-long in the majority of dogs.DOI after vaccination with MLV vaccines is 9 years or longer in the majority of dogs, based on challenge and serological studies (Schultz et al. 2010).DOI for protection from ICH with killed CAV-1 or CAV-2 vaccines is likely to be shorter than for MLV products.MDA will block immunization after vaccination with the parenteral product and so the last dose should be given along with the other core viral vaccines (e.g. CDV, CPV-2) when the puppy is 16 weeks of age or older.After completing the puppy series at 16 weeks or older and vaccinating again at 26 or 52 weeks of age, revaccination need not be done more often than every 3 years.In the absence of MDA, MLV vaccines protect against ICH as early as 5 days after vaccination.The presence of serum antibody, regardless of titre, in an actively immunized dog over the age of 20 weeks is correlated with protection.Precautions Intranasal CAV-2 vaccine is intended as an aid in the prevention of upper respiratory disease caused by CAV-2 and is not intended to protect against CAV-1 infection.Disease Facts 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.After experimental infection with CAV-1, it takes 5 days or longer for signs of ICH to appear.The 'window of susceptibility' is defined as the period of time during which a puppy can be infected by field virus, but vaccines cannot immunize. Unlike CPV-2 vaccines, there generally is not a prolonged 'window' for CAV-2 vaccines (i.e.

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