Vaccination in Animal Shelters

Vaccination is an integral component of any shelter or rescue organization's overall population health management program. Every shelter must develop a vaccination protocol that is tailored to their population's needs, and shelters must be ready to adapt their protocol if changes in overall population health are observed as part of a routine health monitoring program.

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Strategies for vaccination in a shelter or other high-turnover small animal population are different in many ways from those for a privately owned pet. The likelihood of exposure to disease is often very high, and the consequences of infection potentially severe for both the affected animal and the shelter population. A well designed vaccine program can be a life-saving tool to keep shelter animals healthy. Some vaccines provide protection within a few days or even a few hours of administration, and can drastically reduce the frequency of life-threatening disease in the shelter. Other vaccines, while less impressive, can reduce the frequency and severity of disease both within the shelter and after release to adopters or rescue groups. This can help the shelter's reputation and facilitate increased adoptions and improved relations with rescues, conferring a benefit well beyond the vaccine itself.

Of course, vaccination is not a magic bullet for disease prevention. Even the best vaccines take some time to provide protection, and animals may enter the shelter already incubating disease. In addition, vaccination does not provide protection to 100% of vaccinates under the best of circumstances, and animals entering shelters stressed and malnourished may not respond optimally. Finally, vaccines are not available for all diseases of importance in shelters, and do not provide complete protection for some diseases even when there is a vaccine available. Vaccines can help but are never a substitute for good overall animal husbandry.

Questions to consider

As with a private pet in a home, the vaccination strategy should reflect the needs of the particular shelter population. While some generalities can be made, to some extent the vaccine program depends on the prevalent diseases in the area, population characteristics (e.g. low versus high turnover, animal control versus adoption facility, mostly owner surrendered versus mostly stray animals) and shelter resources and philosophy. Ultimately, establishing the ideal vaccine protocol for a particular shelter may require some trial and error. It is important to monitor disease levels before and after trying a new vaccine protocol. Once the level of disease is understood, shelters should consider the questions and answers addressed in this document which apply to most situations.

What pathogens should we vaccinate against?

Core vaccines are vaccines indicated for virtually all shelter animals, and include vaccines against those agents which are very likely to be a threat and for which vaccines are at least somewhat protective. Limiting vaccines to core components reduces cost and incidence of adverse reactions.

Dog Vaccines

Core Vaccines for dogs in shelters:

- Distemper (CDV)
- Adenovirus-2 (CAV-2/hepatitis)

- Parvovirus (CPV)
- Parainfluenza (CPiV)
- *Bordetella bronchiseptica*

The first four antigens are often grouped into one modified live vaccination (DA2PP or DHPP) administered by a single injection given under the dog's skin (subcutaneously/ SQ). Puppies should be vaccinated with DHPP starting at 4-6 weeks of age and revaccinated every 2-4 weeks until 18-20 weeks of age (start at the earlier end of age range and vaccinate at the shorter interval when infectious disease risk is high). Adult dogs should be vaccinated with DHPP once at intake. If resources permit, a second vaccination 2-4 weeks later may be beneficial, especially for dogs that were in poor health when the initial vaccine was given.

Vaccines for *Bordetella bronchiseptica* are available with or without canine parainfluenza and canine adenovirus-2. A recent study showed modest benefit even in a shelter where dogs were likely exposed to high levels of disease early in the shelter stay. [Edinboro, 2004 #762] In general, intranasal vaccination is recommended due to the demonstrated rapid onset of immunity (3-5 days) and the potential benefits of local IgA derived protection. Additionally, this vaccine can be used in puppies as young as 2-3 weeks of age, and may provide local immunity even in the face of maternal antibody.

All puppies and dogs should be vaccinated once on intake with a modified live intranasal vaccine containing at least Bordetella and parainfluenza. Revaccination (or booster vaccination) is generally not necessary with the exception of puppies initially vaccinated prior to 6 weeks of age: revaccinate when the puppy is at least 6 weeks old, no sooner than two weeks after the previous vaccine.

Core-ish vaccine:

Rabies: There is minimal risk of transmission of rabies within a typical shelter environment, but there is great public health benefit in ensuring that all dogs and cats leaving animal shelters are vaccinated for rabies.

Rabies vaccination in shelters, however, is complicated by variable local regulations regarding the level of veterinary supervision required for administration. In some cases it is not permissible to give the rabies vaccine without direct veterinary

supervision. If local regulations/veterinary staffing permit, rabies vaccine should be given at intake for dogs for whom a long term shelter stay is anticipated, and for all dogs in shelters where virtually all dogs are adopted.

For open-intake shelters, rabies vaccination at the time of surgery or release is often more practical. Although ideally vaccines are not given less than two weeks apart, the public health benefit of giving rabies vaccine for all animals on release outweighs this concern, and rabies vaccine should be given even if core intake vaccines were given less than two weeks previously.

If local regulations prohibit shelter staff from vaccinating or adequate veterinary supervision is unavailable, the adopter should be urged to have the animal vaccinated by their veterinarian. A deposit system can help ensure compliance (e.g. where the adopter pre-pays for the vaccine and license and has their money refunded when they return with proof of vaccination).

Canine influenza (CIV): Subcutaneous killed vaccines are available for canine influenza H3N8 strains of (at this time it is unknown whether this vaccine will protect against H3N2 strain). These vaccines are labeled to reduce the severity of clinical signs and decrease the duration of viral shedding, though like many respiratory vaccines they may not completely prevent infection. The vaccines are labeled for use in puppies 6 weeks of age and older, and should be given as two injections, 2-4 weeks apart. The requirement for a booster limits the usefulness of this vaccine in most shelters, but it should be considered for pet dogs that stay in boarding kennels, attend doggy day care centers, frequent dog parks, or otherwise congregate with other dogs, especially in areas known to be endemic for canine influenza. The series of two vaccines should be completed at least two weeks before boarding to allow for optimal immune response. This vaccine may also be useful for shelters in endemic areas if dogs frequently stay for a prolonged period, or for shelters transferring dogs from non-endemic to endemic areas (to be administered *prior to transfer* into an endemic area).

Vaccines not generally recommended (because of undemonstrated efficacy and/or low risk of disease transmission within shelter):

- Canine coronavirus
- Giardia
- Vaccines for diseases which pose minimal infectious risk within the shelter (e.g. leptospirosis, Lyme disease) are generally not indicated until after adoption, when the dog's individual risk profile can be assessed

For more information on canine vaccines visit the AAHA Canine Vaccination Guidelines.

Cat Vaccines

Core Vaccines for cats in shelters:

- Feline herpesvirus-1 (feline viral rhinotracheitis/FHV-1)
- Feline calicivirus (FCV)
- Feline panleukopenia (FPV)

Feline vaccinations are usually grouped into one vaccination (FVRCP). Modified live subcutaneous vaccination is generally recommended because of demonstrated rapid onset of protection and good efficacy in the face of maternal antibody. Kittens should be vaccinated starting at 4-6 weeks of age and revaccinated every 2-4 weeks until 18 -20 weeks of age (start at the earlier end of age range and use the shorter interval when infectious disease risk is high). Adult cats should be vaccinated once at intake. If resources permit, a second vaccination 2-4 weeks later may be beneficial especially if poor health prevented an optimal response to the vaccine given on intake.

Core-ish vaccine:

Rabies: There is minimal risk of transmission of rabies within a typical shelter environment, but there is great public health benefit in ensuring that all dogs and cats leaving animal shelters are vaccinated for rabies. Rabies vaccination in shelters, however, is complicated by variable local regulations regarding the level of veterinary supervision required for administration. In some cases it is not permissible to give the rabies vaccine without direct veterinary supervision. If local regulations/veterinary staffing permit, rabies vaccine should be given at intake for cats for whom a long term shelter stay is anticipated, and for all cats in shelters where virtually all cats are adopted.

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If local regulations prohibit shelter staff from vaccinating or adequate veterinary supervision is unavailable, the adopter should be urged to have the animal vaccinated by their new veterinarian. A deposit system can help ensure compliance (e.g. where the adopter pre-pays for the vaccine and license, if applicable, and has their money refunded when they return with proof of vaccination).

Cat vaccines occasionally recommended:

Use of these vaccines should be reserved only for shelters in which infection has been confirmed by laboratory diagnostics as an ongoing problem.

- ***Chlamydophila felis (C. psittici):*** The efficacy of the vaccine is relatively low (similar to the other respiratory vaccine components), disease is infrequent in most shelters and adverse reactions (lethargy, fever) have been found to be relatively common with this vaccine (Moore, 2007; Starr, 1993). This vaccine should be considered only when disease has been confirmed by laboratory diagnostics and/or very suspicious clinical signs are present. The need for this vaccine should be periodically re-assessed.
- ***Bordetella bronchiseptica:*** Vaccination does not have proven benefit in shelters and may cause mild signs of URI in some vaccinates. This vaccine should be considered when disease has been confirmed by laboratory diagnostics. The need for this vaccine should be periodically re-assessed.

Vaccines not generally recommended (because of undemonstrated efficacy and/or low risk of disease transmission within shelter):

- Feline coronavirus (“FIP vaccine”): There is currently only one vaccine available for feline coronavirus, a modified live intranasal product labeled for use in cats > 16 weeks of age, to be given as a series of two vaccines 3-4 weeks

apart. Results of studies regarding the efficacy of this vaccine have been variable, some showing no efficacy and others showing limited efficacy under certain circumstances. One study showed a significantly decreased risk of FIP for cats that were seronegative at the time of vaccination. Although there may be some benefit to giving the vaccine to cats that have never before been exposed to a multi-cat environment (and are therefore relatively likely to be seronegative), most shelter cats will have long since been exposed by the time the recommended booster vaccine can be administered.

- FeLV: While not generally recommended, this vaccine should be considered in shelters/sanctuaries with group housing, especially if groups are large (> 10-12 cats), stays are relatively long (>1-2 months) and/or there are cats in the group not tested for FeLV within the previous year. Vaccination is not a substitute for testing and segregating FeLV positive cats, but because the occasional positive cat may test negative (especially soon after infection) and be inadvertently introduced into an FeLV negative group, cats that will be exposed to many other cats in a shelter group housing setting may benefit from vaccine protection.
- FIV: Because of the low risk of transmission within most shelters and interference with antibody tests for FIV, this vaccine is not generally recommended. However, it may have benefit in sanctuaries where large numbers of cats are group housed (in or out doors) long term.

For more information refer to the American Association of Feline Practitioners Vaccination Guidelines.

Types of Vaccines Available

Vaccines are categorized as modified live (MLV), inactivated (IA) and recombinant. Each type of vaccine has advantages and disadvantages. In shelters, the most important aspects of each vaccination choice are outlined here. In the majority of cases, modified live vaccines are the preferred choice in shelters.

Modified live vaccines (MLV)

Advantages of modified live vaccine (MLV):

- Can provide a **relatively rapid onset of immunity after a single vaccine dose** against some pathogens

(Significant protection within hours to days for some diseases such as parvovirus, panleukopenia and canine distemper. For other diseases, such as feline respiratory vaccines, this is not the case.)
- Better able to **overcome maternal antibody** interference
- Produces mucosal immunity when given by appropriate route (important for prevention of some respiratory diseases)

Disadvantages of modified live vaccine (MLV):

- Can produce mild signs of disease indistinguishable from natural infection. However, this is likely rare in shelters; several studies have not shown an increased risk of mild signs of respiratory disease even in dogs and cats recently vaccinated with a modified live intranasal vaccine. It is likely that the level of vaccine induced signs is rarely sufficient to trigger notice at a shelter where monitoring is often not as close as in a pet home.
- Can cause shedding of antigen which may be indistinguishable from field strain on diagnostic tests
- May establish infection and carrier state with vaccine strain virus; this can occur with the feline respiratory viruses. Once carrier state is established, virus may be continually shed into the environment, increasing the possibility of reversion to virulence
- Some MLV vaccines can produce significant disease in severely immunosuppressed animals. “Everyday” immunosuppression associated with such things as stress, poor nutrition, surgery have not been shown to increase vaccine induced disease. Genetic immune deficiency, chemotherapy, or parvoviral infection are more significant risk factors [Greene, 1998; Miyamoto, 1995]. Animals so severely immunosuppressed that vaccination poses a meaningful risk are unlikely to survive exposure to the many pathogens in a shelter; *a rule of thumb is that an animal not healthy enough to vaccinate should not remain in a shelter except under strict isolation.*
- Some MLV vaccines (e.g. feline panleukopenia, parvovirus) may cause death or disease of fetuses and very young animals. In some cases, however, this risk is outweighed by the benefit of protection against these same illnesses in a high risk environment.
- MLV vaccines can be inactivated by incorrect storage or handling

- May produce significant disease when given by the incorrect route (e.g. sub-cutaneous FVRCP given intranasally, intranasal *Bordetella bronchiseptica* given parentally)

Inactivated vaccines

The advantages and disadvantages of inactivated (IA) vaccines reflect the flip side of those listed for modified live vaccines. Inactivated vaccines will not cause shedding of antigen nor cause disease even in pregnant or very young animals, and are much more tolerant of variations in storage and handling.

The most significant disadvantage of inactivated vaccines is that for some serious diseases such as panleukopenia, protection will not be acquired until 1-2 weeks after a booster vaccine is given (2-3 weeks after initial vaccination). This means naive animals will not be protected for up to five weeks after vaccination! In many shelters the animal will likely have been exposed to disease by the time protection is achieved.

For all their advantages of safety and store-ability, then, this single problem greatly limits the usefulness of IA vaccines in the shelter environment for protection against panleukopenia, parvovirus and canine distemper.

Other Vaccine types

Other types of vaccines containing synthetic or genetically engineered antigen have been developed. For example, a recombinant vaccine for canine distemper is available. While recombinant vaccines may offer good protection with minimal side effects, purified or recombinant products often require the same booster schedule and time to onset as an inactivated vaccine.

Recombinant vaccines are also generally more costly than traditional MLV or IA. These factors limit use of recombinant products in shelters. However, a recombinant vaccine for canine distemper (Merial) has been shown to provide rapid protection similar to standard MLV vaccines, and relatively good efficacy in the face of maternal antibody (Larson, 2006). This advantage, however, may be limited in shelters where few puppies may have maternal antibodies to distemper. In the future, attenuated

products may be produced using selective deletion or vectored delivery systems with the advantages of a modified live vaccine and the safety of a killed vaccine. Stay tuned.

So which vaccine should shelters use?

For protection against parvovirus, panleukopenia, and canine distemper, MLV SQ vaccines are preferred. For canine core vaccines, most available vaccines are modified live combination products which include distemper, canine adenovirus 2, parvovirus and parainfluenza (DA2PP or DHPP). Although a recombinant canine distemper vaccine is available as noted above, its application in a most shelter settings is limited. If *Bordetella bronchiseptica* vaccine is used (with or without adenovirus 2 or parainfluenza), a modified live intranasal product is generally indicated due to the more rapid onset of protection. For more information on vaccination for canine infectious respiratory disease complex, please see our canine infectious respiratory disease information page.

For cats, the core vaccines are available as inactivated or modified live combination products (feline viral rhinotracheitis, calicivirus and panleukopenia, FVRCP). In recent years, feline panleukopenia has re-emerged as a near-ubiquitous threat. Vaccine-induced protection against FPV is excellent. **Routine use of a modified live parenteral vaccine containing panleukopenia will provide optimal protection against outbreaks of this devastating disease.**

The case for modified live versus inactivated vaccines against feline respiratory viruses (feline calicivirus and herpesvirus, the "FVRC" in "FVRCP") is less clear cut. Vaccines against these viruses provide only partial protection at best, making the risk/benefit ratio less obvious than with FPV. Feline respiratory vaccines do not protect against infection or development of a carrier state, and resistant strains of feline calicivirus are common [Pedersen, 1995; Weigler, 1997] [Lauritzen, 1997] [Dawson, 1993].

Some cats will experience mild signs of URI such as sneezing or mild oral inflammation after modified live vaccination. This is more common with intranasal vaccines but may occur with parenteral vaccines as well. Inactivated products are also preferred for shelters or mobile operations without the ability to

correctly store modified live vaccines. Both MLV and IA vaccines often require a booster for maximum effect, and one study suggested that IA vaccines may actually be more effective in inducing antibodies against feline herpesvirus than MLV vaccines. This needs to be taken with a grain of salt, as antibodies are not necessarily correlated with protection against infection or illness caused by herpesvirus, but the fact remains that either choice is likely to afford less than ideal protection and strong evidence for one over the other is lacking.

Inactivated calicivirus vaccines containing two strains of calici are now available in the U.S. and Europe and may provide broader protection against infection. Provided these vaccines can be given in combination with a MLV SQ panleukopenia vaccine, they may confer some advantage over the single strain vaccines.

Intranasal vaccines for cats are modified live, and are available as bivalent products containing only the respiratory viruses, or trivalent containing the respiratory viruses and feline panleukopenia. Because intranasal vaccination is not reliably effective to protect against feline panleukopenia, all cats should be vaccinated with a parenteral MLV panleukopenia vaccine, regardless of whether or not IN respiratory vaccines are used. Studies conflict on the possible benefit of this vaccine in shelter settings, and it likely varies by shelter. See the feline upper respiratory infection information page for more information about use of the IN vaccine in shelters.

Which animals should be vaccinated?

All animals should be considered unvaccinated unless a documented medical record exists. Therefore, with a few exceptions described below, **all animals over 4 weeks of age regardless of health status should be vaccinated upon shelter entry** provided they can be safely handled. Special consideration should be given to animals with medical conditions, pregnant and animals < 4 weeks old.

Animals with medical conditions:

In general, even injured animals and those with medical conditions should be vaccinated. Although they may not mount

an optimal response, the risk of exposure to the full strength pathogen is too great in most shelters to warrant delaying vaccination. Vaccination can be repeated after recovery (no less than two weeks later.) There is nothing more frustrating than treating an animal for an injury only to have it succumb to infectious disease.

Vaccine response has been shown to be impaired in animals with a temperature of >103.6 whether due to fever or high environmental temperature [Greene, 1998]. If possible, such animals should be cooled down prior to vaccination. Animals with *severe* immunosuppression (such as cats symptomatic for FIV or animals being treated with some chemotherapeutics) should be carefully isolated and given killed or recombinant vaccines if available. Remember, if an animal is too immune-suppressed to be safely vaccinated, it is unlikely to survive exposure to all the many pathogens present in a typical shelter environment.

Other conditions that must be considered:

1.The age of the animal - Modified live parvovirus/panleukopenia vaccines should not be given to puppies or kittens less than four weeks old. Intranasal/intraocular vaccines for upper respiratory infection may be used in puppies and kittens as young as 2-4 weeks old. (The 3 way intranasal FVRCP vaccine cannot be used, however, as the panleukopenia component is contraindicated as described above.)

2. Pregnant animals - Although very little data exists, it is thought that in a mother who has never been vaccinated or exposed, modified live parvovirus and panleukopenia vaccines may cause abortion or fetal damage. In mothers who have been previously immunized, on the other hand, there is likely no risk to the litter. In one study, abortions were no more common in queens vaccinated with an MLV FVRCP vaccine during pregnancy, and their kittens were considerably less likely to suffer from upper respiratory infection than kittens born to queens not vaccinated during pregnancy. (We can chalk that benefit up to the increased maternal antibody received by the litter.) The bottom line is, there is likely some risk of causing fetal damage when we vaccinate pregnant animals who have never been vaccinated before. On the other hand, there is risk in not vaccinating: if the mother contracts a fatal illness, both mother and litter will be lost. It all comes down to weighing the

risk of exposure versus the risk to the litter. If you almost never see serious disease in your shelter or you can reliably prevent exposure, then the risk may outweigh the benefit. If risk of exposure is reasonably high, then the benefit of vaccination likely outweighs the risk. If URI is a frequent problem in foster litters, that provides further reason to vaccinate during pregnancy.

Keep in mind the special considerations for a legal hold – there are many reasons besides vaccination for abortion, but a vaccine may be blamed if given to an animal at the center of a contentious legal case. In that situation, make every effort to find out the animal's vaccine status from the owner, and either gain consent from the owner for vaccination or carefully protect her from exposure to illness rather than risking a vaccine without consent. Finally, any time a pregnant-spay is planned, immediate vaccination of the pregnant animal is indicated.

3. Finally, live outcome is sometimes a factor when deciding who should be vaccinated. As discussed above, shelters which euthanize a high proportion of animals may limit vaccines to animals deemed likely to have a live outcome. Although preferable to not vaccinating at all, this approach has several disadvantages:

- Numerous non-vaccinates in the population may lead to overwhelming levels of disease in the environment
- Animals deemed unadoptable but redeemed by their owners will be at risk of acquiring infectious disease at the shelter and may carry that disease back into the community
- Animals that do not seem adoptable at first but come around after a few days will be at risk

When should the vaccine be given?

Immediately upon intake, if not sooner! In almost all cases, shelter animals should be vaccinated immediately upon intake. A delay of even a day or two will significantly compromise the vaccine's ability to provide protection. In a cost saving effort, some shelters delay vaccination until the animal is made available for adoption, or even until it is adopted. While this does provide a service to adopters, the protective effect of the vaccine within the shelter is greatly reduced or eliminated. (In some cases, the chance of the vaccine preventing disease may

be 90% or better if given the day before exposure, but will drop to less than 1% if given the day after exposure.) When possible, vaccination prior to intake is ideal (e.g. for owner surrendered animals or those returning from foster care).

An exception to this rule should be made for animals that are not good candidates for vaccination upon shelter entry due to severe disease (as described previously). For shelters which euthanize the great majority of their population, vaccinating all animals upon intake may be impractical. Resources may be better spent on improving adoption opportunities in this case. Good adoption candidates should still be identified and vaccinated upon intake, however, rather than waiting until the end of the holding period to make this decision. This will facilitate work with rescue groups as well as improving the animal's chance of surviving its shelter stay.

As return to field/shelter neuter return programs become more common the question of when to vaccine these cats should be given consideration. The stress and safety of both the cat and the staff need to be taken into consideration.

The main reason to vaccinate on intake rather than at the time of surgery would be for panleukopenia protection. Some protection from this vaccine kicks in within 24 hours, so if, say, someone prepping cats for surgery happened to have panleukopenia on their hands or scrubs from handling another cat that was shedding, cats would be at least partially protected. That said, cats that are difficult to vaccinate will also receive minimal handling, thus minimal opportunities to be exposed to panleukopenia during their shelter/TNR clinic stay. If the following is true, waiting to vaccinate until the time of surgery will probably create little risk and save significant stress for cats as well as time and risk for staff:

- Cats are placed in housing that has been thoroughly disinfected with a parvocidal disinfectant (Accel, Trifectant, properly handled bleach on pre-cleaned non-porous surface)
- Cats are not handled during their time at shelter/awaiting surgery, or handled only by staff wearing PPE and using sanitized equipment (not per cat, but per group – e.g. they throw on a clean scrub top or protective smock and freshly wash hands or put on a new pair of gloves when entering that ward to care for cats or to examine individuals)
- Sick cats are not housed in the same area with healthy cats,

or are handled separately/with change of PPE and equipment between
- Staff and equipment for surgery is sanitized/separate from sick cats – e.g. techs do not first go through and treat all the sick cats, perform euthanasia, clean kennels or other contaminating activities, then assist with surgery without a change of PPE (this is surprisingly not uncommon as it tends to work well with the flow of the day to get some heavily contaminating activities taken care of before surgery commences, in a shelter that does not have staff allocated to specific separate areas. This can be ok as long as care is taken to have a full change of PPE between activities).

Basically these are similar precautions to those that should always be taken with kittens, who cannot be reliably protected by vaccination until the age of 4-5 months. This is not no-risk but it is low risk and as noted, there are also risks to vaccinating feral-ish cats when they are wide awake. A bit of a balance for each shelter/system to weigh.

What should the revaccination (booster) schedule be?

For inactivated vaccines (such as FeLV) and subcutaneous vaccines against respiratory infection, booster vaccination is required within 2-6 weeks of the previous vaccination. For young animals, the booster must be received following the first vaccine to penetrate the maternal immune response; therefore these vaccines should not be administered until it is reasonably certain that maternal antibody has waned at ~ 4 months of age. If a booster vaccine is not given within 6 weeks of initial vaccination, the two-vaccine series should be repeated.

In animals with a normal immune response, booster vaccines per se are not required for modified live vaccines against canine parvovirus, canine distemper or feline panleukopenia. Repeated vaccines for these diseases are given to animals under ~four months of age in order to minimize problems with maternal antibody interference. Revaccination may also be indicated in case of a sub-optimal immune response to the initial vaccination.

Puppies and kittens should be vaccinated every 2-3 weeks until they reach 18-20 weeks of age. Consider revaccination of adults in 2-3 weeks or after adoption. If inactivated vaccines are used, all animals must receive a booster 2-4 weeks later.

As noted, booster vaccines are not normally needed for modified live products. However, animals in shelters may not respond optimally to the initial vaccine, especially if they were in a debilitated condition at the time. Particularly if the animal was mildly ill at the time of initial vaccination, a second vaccine after recovery may be helpful (at least two weeks later). Alternatively, a recommendation could be made to adopters to discuss revaccination along with additional indicated preventive health measures with their own veterinarian. Although this imposes a slight extra cost on adopters and subjects the animal to another vaccination, parvovirus infection in a “supposedly vaccinated” adopted animal is well worth avoiding.

A few words on maternally derived antibodies:

Maternally derived antibodies (MDA) are transmitted primarily in colostrum received by nursing puppies and kittens in the first 24-72 hours of life. The level of protection from maternal antibodies depend on the quality of the mother’s colostrum (that is, the amount of antibody it contains) and the amount ingested and absorbed by the neonate. Low levels of antibody may exist if the mother was neither immunized nor naturally exposed, or if the puppies or kittens did not nurse well due to illness, stress or separation from mom.

Maternal antibodies are a mixed blessing in the shelter environment. They provide much needed protection while the newborn animal’s immune system develops, but also can prevent effective vaccination for up to ~20 weeks. At the age of 4-6 weeks, maternal antibody levels start to decrease, and they are usually gone by the age of 16-18 weeks. The problem is, there is a variable time period over which the level of maternal antibodies wanes, so we never know exactly when the levels will be low enough to no longer protect the animal and to allow effective vaccination.

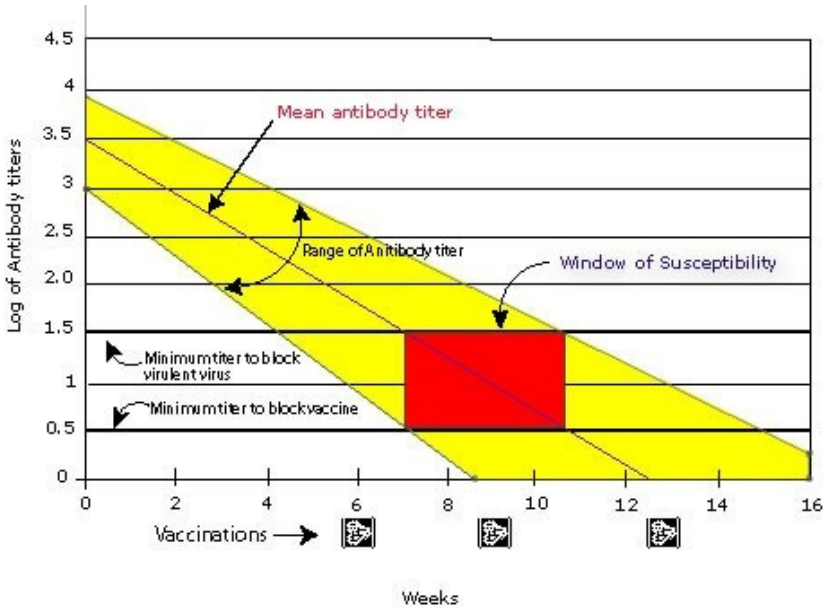

Figure 1. Window of susceptibility - The time at which antibody level is no longer sufficient to protect from infection, yet high enough to prevent protection (i.e. immunity) from a vaccination

During the "window of susceptibility" antibody levels are sufficient to prevent protection from a vaccination but inadequate to prevent infection (Figure 1). The time at which this window occurs depends on the disease agent and the amount of antibodies initially present. For most diseases, this window occurs somewhere between 6-16 weeks old. Although greatly reduced by “high antigen mass” vaccines now widely available, this window still exists and is particularly a problem with parvovirus vaccination.

Proper Vaccine Handling and Administration

In order to be effective, vaccines must be stored and administered correctly. Following manufacturer directions not only preserves efficacy of the vaccine, it makes it easier to obtain manufacturer support in cases of vaccine failure or adverse reactions. As in private practice, date of vaccination, vaccine type, manufacturer and serial number should be entered into a permanent medical record. At minimum, vaccine type and date must be recorded for each animal and the dates of use for each batch recorded by serial number in some central location in case of adverse reactions.

Handling and storage

Heat, excessive cold, and exposure to light are capable of inactivating vaccines. Modified live vaccines should arrive cold from the manufacturer and be refrigerated immediately (needed storage temperature will be indicated on the vaccine label). Always refrigerate vaccines away from the freezer compartment (excessive cold can alter the vaccine, which may cause pain and local reactions to injection). Modified live vaccines that have not been refrigerated for more than 2 hours may be ineffective and should be discarded.

Vaccine preparation

Always follow the manufacturer's guidelines for preparing the vaccine. Use appropriate size syringe and needle to safely prepare and administer the vaccine. In most cases, a 3cc Lure-lock type syringe with a 22 gauge inch needle is appropriate. Smaller gauge needles may be used, but may result in slower administration. Use only one vaccine per single-use syringe and needle. Use only the diluent provided by the manufacturer. Vaccines that are reconstituted in a diluent must be completely dissolved before drawing into syringe. Put a new 22 gauge needle onto the syringe before administering the vaccine to the animal.

Administration

All vaccines should be administered only by the route designated by the manufacturer. Administration by the wrong route may cause serious disease or death. Intranasal canine *Bordetella* vaccine may cause severe reactions if given subcutaneously. Modified live subcutaneous feline FVRCP vaccine may cause serious upper respiratory infection if administered intranasally, or even if a cat licks up spilled vaccine. If a vaccine is accidentally given by the wrong route, the vaccine manufacturer should be contacted for specific recommendations. If an injectable vaccine is spilled, clean vaccine off animal's fur with alcohol swabs.

Modified live vaccines should be administered as soon as they are reconstituted. Certain components of the vaccine begin to deteriorate quickly once reconstituted. If MLV vaccines sit for more than 20 minutes between when they are reconstituted and when they are given, they should be discarded and a new

vaccine should be reconstituted and given. Thus the practice of drawing up a day's worth of vaccine in the morning to be given all day at the shelter is inappropriate and will lead to ineffective vaccines being administered.

Parenteral (subcutaneous) vaccine administration procedure

1. Always have enough people and use proper animal restraint to administer the vaccine safely
2. Gently grasp and lift a fold of skin to tent the skin over the proper location
3. Insert the needle into the fold of skin (make sure that the needle is all the way into the subcutaneous space but not poking through to the other side of the fold)
4. Aspirate by drawing back on the syringe plunger - you should encounter some resistance. If you draw back and aspirate anything other than a small bubble of air (often trapped in the needle hub):
    I. Remove the needle from the skin
    II. Check needle for proper seal on syringe, replace if defective
    III. Reinsert needle into skin
5. Depress the plunger slowly to inject the vaccine. If a large amount of resistance is encountered, reposition the needle into the subcutaneous space and attempt to re-inject.
6. When vaccine is completely injected, remove needle from skin
7. Dispose of syringe and needle appropriately
8. Check the injection site immediately afterward for any blood or spilled vaccine
9. Gently massage the vaccine area to disperse the vaccine under the skin

Locations of vaccine injections

DOGS

Most subcutaneous vaccines should be given in the subcutaneous space between the shoulder blades. Rabies vaccines are generally administered in the right rear leg.

CATS

Follow the guidelines from the American Association of Feline

Practitioners, with all vaccines given as far down on the limb as possible:

- FVRCP - Right shoulder
- Rabies - Right rear leg
- FeLV - Left rear leg

Intranasal/intraocular vaccine administration procedure

These vaccines should be administered topically according to the manufacturer's instructions.
Use a single use syringe for each vaccination. Splitting vaccine for very young kittens may be acceptable, check with the vaccine manufacture.

Vaccine reactions

- Local inflammation, swelling or hair loss (most common)
- Mild symptoms such as sneezing or lethargy
- Systemic reactions:
    - Fever and limping secondary to MLV feline calicivirus in kittens - Usually responsive to analgesics, resolves in 3-4 days
    - Vaccine associated hypertrophic osteodystrophy and juvenile cellulitis associated with modified live distemper vaccination. This is most common in Weimaraners, occasionally seen in other large breeds.
    - Vaccine site sarcomas - AAFP guidelines should be followed - http://www.catvets.com/guidelines/practice-guidelines/feline-vaccination-guidelines
    - Anaphylactic shock (type 1 hypersensitivity)

Fortunately the more severe reactions are very uncommon, and the benefits of vaccinating shelter animals greatly outweigh the risks. Reported reactions in one study were estimated at .004%. However, many shelters care for thousands or even tens of thousands of animals a year, leading to a high probability of eventually seeing a serious reaction.

All adverse vaccine reactions should be documented on the animal's permanent record so that adopters can be made aware of this history. Even mild reactions such as vaccine site swelling should be noted and monitored closely. Anaphylactic shock in particular requires immediate recognition and treatment.

If vaccines are administered by staff other than the veterinarian, clear written directions should be posted regarding recognition and treatment of anaphylactic shock ("treatment" may include taking the animal immediately to a local emergency clinic if resources are available and treatment in-house exceeds staff training). A crash kit for treatment of anaphylactic shock should be available at all times.

Adverse effects of vaccines given by the incorrect route

Some modified live vaccines can produce significant disease when given by the wrong route. Intranasal *Bordetella* vaccine inadvertently given subcutaneously can cause a local inflammatory reaction, abscessation and in rare cases severe complications including liver failure and death [Toshach, 1997]. The most important thing is to make sure such mistakes are reported so the animal can be monitored and treated accordingly (not so staff get in trouble – it can happen to anyone!). Inadvertent or intentional administration of a vaccine by the intravenous route may cause acute an anaphylaxis and is not recommended under any circumstances.

Feline respiratory virus vaccines (FVRC)

Modified live parenteral feline respiratory virus vaccines are temperature sensitive mutants that depend on being given at the higher core body temperature in order to reduce virulence. When these vaccines are accidentally given by the oro-nasal route, severe upper respiratory infection can develop. This is most likely due to the calicivirus component, and most commonly occurs when vaccine is spilled on the cats fur (e.g. when the needle is poked all the way through and out the skin instead of placed in the subcutaneous space).

In order to avoid this:
1. Draw up vaccine and eliminate air bubbles well away from the cat's face
2. Immediately wipe any spilled vaccine with alcohol (on the cat) or Accel/Trifectant/bleach (in the environment)

Vaccine failures

Vaccines may fail to protect animals for a variety of reasons,

including:

Animal problems:

1. Already infected at time of (or soon after) vaccination. This is the most common reason for failure in shelters.
2. Maternal antibody interference (Figure 1 above)
3. Failure to mount immune response

Response to vaccination follows a bell curve. There will always be a few outlying animals which do not respond well to a vaccine. Even excellent vaccines given correctly ***will not protect 100% of animals.***

Always remember that vaccine can never generate better protection than natural infection. For agents such as feline herpesvirus or feline calicivirus that do not produce sterilizing immunity even with full blown disease, vaccines cannot offer complete protection.

Potential sources of vaccine problems:

1. Incorrect storage or administration
2. Use of chemicals to sterilize re-used syringe
3. Vaccine antigens not protective against field strain virus
4. Problem in manufacturing of vaccine

If a shelter is experiencing vaccine preventable disease (e.g. parvovirus, distemper and panleukopenia) in “vaccinated”, adult animals, the first place to evaluate is intake to ensure that proper storage, handling, preparation and administration of the vaccines is occurring. If there are errors occurring in any of these areas, ineffective vaccines will be given and thus animals will go unprotected.

Every shelter must have a well thought out vaccination strategy. However, always remember that this can reduce, but not ever completely eliminate, vaccine failures.

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