VITAL VACCINATION SERIES

DOGS & CATS OVERDUE FOR VACCINATION

Recommendations for Updating Immunizations

Richard B. Ford, DVM, MS, Diplomate ACVIM & ACVPM (Hon)

Published vaccination guidelines for dogs and cats enable the clinician to implement vaccination protocols tailored for individual patients that provide protective immunity at the appropriate stages of life.1,2

However, protocols used in practice generally assume owner compliance with the recommended, ideal vaccination schedule. In reality, clientele don’t always, or aren’t able to, adhere to the “ideal.”

This article addresses options for immunizing dogs and cats significantly overdue for scheduled vaccine appointments. Remember, however, that recommendations outlined are based largely on expert opinion; published scientific studies on revaccination requirements for overdue patients are limited.

In addition, a multitude of intrinsic (eg, age, genetics, maternally derived antibody) and extrinsic (eg, vaccine type, number of previous vaccine doses, time since last dose was administered, risk for exposure) factors impact an individual patient’s immunity and need for additional vaccine doses.

Therefore, it is ultimately the decision of the individual clinician to determine what vaccines and how many doses should be recommended.

CONVENTIONAL RECOMMENDATIONS

Core Vaccines

Core vaccines—those that should be administered to all dogs and cats—are listed in Table 1.

This is the second article in Dr. Richard Ford’s Vital Vaccination Series in Today’s Veterinary Practice. Read the first article—Canine Vaccination Guidelines: Key Points for Veterinary Practice (September/October 2012)—at todaysveterinarypractice.com.

TABLE 1. Core and Noncore Vaccines for Dogs and Cats (Organized Alphabetically)

<table>
<thead>
<tr>
<th>CANINE CORE VACCINES</th>
<th>FELINE CORE VACCINES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canine adenovirus (CAV-2)</td>
<td>Feline calicivirus (FCV)</td>
</tr>
<tr>
<td>Canine distemper virus (CDV)</td>
<td>Feline herpesvirus-1 (FHV-1)</td>
</tr>
<tr>
<td>Canine parainfluenza virus (CPiV)</td>
<td>Feline leukemia virus (FeLV)</td>
</tr>
<tr>
<td>Frequently included as core vaccine in U.S. and Canadian practices</td>
<td>Recommended core vaccine for all kittens</td>
</tr>
<tr>
<td>Canine parvovirus-2 (CVP-2)</td>
<td>Feline parvovirus (FPV or panleukopenia)</td>
</tr>
<tr>
<td>Rabies vaccine is recommended as core for all dogs and cats.</td>
<td></td>
</tr>
<tr>
<td>CANINE NONCORE VACCINES</td>
<td>FELINE NONCORE VACCINES</td>
</tr>
<tr>
<td>Bordetella bronchiseptica Intranasal, parenteral, or oral</td>
<td>Bordetella bronchiseptica Intranasal only</td>
</tr>
<tr>
<td>Canine influenza virus (CIV)</td>
<td>Chlamydia felis</td>
</tr>
<tr>
<td>Crotalus atrox Western diamondback rattlesnake</td>
<td>Feline immunodeficiency virus (FIV)</td>
</tr>
<tr>
<td>Leptospirosis</td>
<td>Feline leukemia virus (FeLV) Noncore for adult cats</td>
</tr>
<tr>
<td>Lyme borreliosis</td>
<td>Virulent systemic feline calicivirus</td>
</tr>
<tr>
<td>Parainfluenza virus Intranasal or parenteral</td>
<td></td>
</tr>
</tbody>
</table>

Notes
- Vaccines listed are licensed by the USDA and may not be available in all countries.
- Canine and feline (FIP) coronavirus vaccines, although licensed products, are not recommended.

PEER REVIEWED
**Initial Vaccination**
Recommendations for initial vaccination of young dogs and cats generally include:
- **Core vaccines except rabies**: 3 doses between 6 and 16 weeks of age
- **Rabies vaccine**: Single dose at no less than 12 weeks of age
- **Vaccination intervals**:
  - Minimum recommended interval (dogs and cats) between any 2 vaccine doses is 2 weeks.¹
  - Maximum recommended interval (dogs) is 6 weeks.¹
  - Current feline vaccination guidelines recommend 3- to 4-week interval between doses during initial vaccination series for kittens.²

My opinion is that a maximum 6-week interval between doses can be applied to both dogs and cats without jeopardizing immunologic outcome. Discussions with veterinarians who follow published vaccination guidelines indicate that many practices recommend administering core vaccines at 2, 3, and 4 months of age in both dogs and cats.

**Revaccination**
Revaccination (booster) with core vaccines, including rabies, is recommended for all dogs and cats 1 year following completion of initial (juvenile) series. Revaccination is generally recommended at 3-year intervals thereafter.

Although all states currently recognize the 3-year rabies vaccines, local (city/county) requirements may mandate annual revaccination against rabies for dogs and cats.

With the exception of rabies, the decision to revaccinate a dog or cat annually versus triennially is left to the discretion of the clinician.

**Noncore Vaccines**
Noncore—optional—vaccines are listed in Table 1.

**Initial Vaccination**
The number of initial doses required may vary according to manufacturer recommendations and vaccine type—recombinant versus attenuated (live) versus inactivated (killed).
- **Parenterally Administered Vaccines**: Administer at least 2 doses, 2 to 6 weeks apart, regardless of patient’s age at time of initial vaccination; this is particularly important when administering inactivated vaccines.
- **Mucosally (Intranasal or Oral) Administered Vaccines**: These vaccines contain attenuated bacteria or virus; because the immunizing organism is live, a single dose is expected to immunize.

  - However, discussions with veterinarians indicate that many practices currently recommend 2 initial doses of intranasal vaccines.
  - There are no contraindications to recommending 2 initial doses.
  - Maternal antibodies do not interfere with vaccines administered mucosally.

- **FeLV Vaccines**: Whether recombinant or inactivated, 2 initial doses are required to immunize.

**Revaccination**
Assuming a patient has received the initial 2 doses of a noncore vaccine, a single booster dose is recommended annually for adult dogs or cats with reasonable risk for exposure to the virulent bacteria or virus.

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**TABLE 2. Vaccination Recommendations: Puppies Overdue During Initial Vaccination Series**

<table>
<thead>
<tr>
<th>VACCINE TYPE</th>
<th>OVERDUE</th>
<th>RECOMMENDATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Canine adenovirus-2 (attenuated)</td>
<td>Overdue if more than 6 weeks have lapsed since previous dose in series.</td>
<td>• Administer single dose if 16 weeks of age or older.</td>
</tr>
<tr>
<td>Canine distemper (attenuated)</td>
<td></td>
<td>• Administer 2 doses, 2–6 weeks apart, if less than 16 weeks of age.</td>
</tr>
<tr>
<td>rCanine distemper (recombinant)</td>
<td></td>
<td>• Option: Administer 2 doses, 2–6 weeks apart, to any overdue patient.</td>
</tr>
<tr>
<td>Canine parainfluenza virus (attenuated, parenteral)</td>
<td></td>
<td>• Administer 2 doses, 2–6 weeks apart, to overdue patients.</td>
</tr>
<tr>
<td>Canine parvovirus-2 (attenuated)</td>
<td></td>
<td>• Administer 2 doses, 2–6 weeks apart, to overdue patients.</td>
</tr>
<tr>
<td>B bronchiseptica + parainfluenza (attenuated, intranasal)</td>
<td>Not applicable: Single dose expected to immunize</td>
<td></td>
</tr>
<tr>
<td>B bronchiseptica (attenuated, oral)</td>
<td>Not applicable: Single dose expected to immunize</td>
<td></td>
</tr>
<tr>
<td>B bronchiseptica (inactivated, parenteral)</td>
<td>Overdue if more than 6 weeks have lapsed since previous dose in series.</td>
<td>• Administer 2 doses, 2–6 weeks apart, to overdue patients.</td>
</tr>
<tr>
<td>All other noncore vaccines (inactivated; also recombinant Lyme vaccine)</td>
<td>Overdue if more than 6 weeks have lapsed since previous dose in series.</td>
<td>• Administer 2 doses, 2–6 weeks apart, to overdue patients.</td>
</tr>
<tr>
<td>Rabies (inactivated)</td>
<td>Overdue if more than 12 months have lapsed since initial dose.</td>
<td>• Administer single dose of a labeled 1- or 3-year vaccine.</td>
</tr>
</tbody>
</table>

**Note**: Generally, patient considered “vaccinated” for labeled duration on product; local statutes may vary from this recommendation.

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¹ My opinion
² Current feline vaccination guidelines recommend 3- to 4-week interval between doses during initial vaccination series for kittens.
³ My opinion

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**Note**: All vaccines administered parentally unless otherwise noted.
### TABLE 3. Vaccination Recommendations: Kittens Overdue During Initial Vaccination Series

<table>
<thead>
<tr>
<th>VACCINE TYPE</th>
<th>OVERDUE</th>
<th>RECOMMENDATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feline calicivirus (attenuated)</td>
<td>Overdue if more than 6 weeks have lapsed since previous dose in series.</td>
<td>• Administer single dose if 16 weeks of age or older. &lt;br&gt;• Administer 2 doses, 2–6 weeks apart, if less than 16 weeks of age. &lt;br&gt;• Option: Administer 2 doses, 2–6 weeks apart, to any overdue patient.</td>
</tr>
<tr>
<td>Feline herpesvirus-2 (attenuated)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Feline parvovirus (attenuated) (parenteral or intranasal)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B bronchiseptica (attenuated, intranasal)</td>
<td>Not applicable: Single dose expected to immunize</td>
<td></td>
</tr>
<tr>
<td>Chlamydia felis (attenuated or inactivated)</td>
<td>Overdue if more than 6 weeks have lapsed since previous dose in series.</td>
<td>• Administer single dose if 16 weeks of age or older. &lt;br&gt;• Option: Administer 2 doses, 2–6 weeks apart, to any overdue patient.</td>
</tr>
<tr>
<td>Feline leukemia (recombinant or inactivated)</td>
<td>Overdue if more than 6 weeks have lapsed since previous dose in series.</td>
<td>• Administer 2 doses, 2–6 weeks apart, to overdue patients. &lt;br&gt;• Note: Manufacturer recommends 3 initial doses.</td>
</tr>
<tr>
<td>Feline immunodeficiency virus (inactivated)</td>
<td>Overdue if more than 6 weeks have lapsed since previous dose in series.</td>
<td>• Administer 2 doses, 2–6 weeks apart, to overdue patients. &lt;br&gt;• Note: Generally, patient considered “vaccinated” for labeled duration on product; local statutes may vary from this recommendation.</td>
</tr>
<tr>
<td>Virulent systemic calicivirus (inactivated)</td>
<td>Overdue if more than 6 weeks have lapsed since previous dose in series.</td>
<td>• Administer 2 doses, 2–6 weeks apart, to overdue patients.</td>
</tr>
<tr>
<td>Rabies (recombinant or inactivated)</td>
<td>Overdue if more than 12 months have lapsed since initial dose.</td>
<td>• Administer single dose of a labeled 1- or 3-year vaccine. &lt;br&gt;• Note: Generally, patient considered “vaccinated” for labeled duration on product; local statutes may vary from this recommendation.</td>
</tr>
</tbody>
</table>

**Notes:**
- Inactivated feline parvovirus, herpesvirus-1, and calicivirus vaccines are available but not generally recommended for use in feline vaccination protocols. If administering inactivated vaccine, kittens overdue during initial series should receive 2 doses, 2 to 6 weeks apart.
- All vaccines administered parentally unless otherwise noted.

- There are no published 3-year recommendations for noncore vaccines.
- Some authors recommend a 2-year interval for FeLV revaccination in adult cats, regardless of product used.

**Owner compliance** with the initial vaccination series should be stressed during the first examination to provide maximum protection during the most vulnerable stage of life.

**OVERDUE-FOR-VACCINATION RECOMMENDATIONS**

In the event a pet owner does not, or is not able to, adhere to the conventional vaccination schedules outlined, the following recommendations provide reasonable, alternative schedules that offer the most appropriate vaccines at the most appropriate intervals.

**Overdue During Initial Vaccination Series**

For the juvenile (< 16 weeks of age) dog and cat, the initial vaccination series with core vaccines is critical.

During this series, a dog or cat can be considered overdue for vaccination if the patient is not returned within 6 weeks following administration of the previous dose. However, there are no published studies defining the specific intervals between initial doses of vaccine required to assure a protective immune response.

It is reasonable to recommend an alternative vaccination schedule for a dog or cat determined to be overdue. Deciding which vaccine should be administered and when is based on 2 factors:

1. **Elapsed time** since the previous dose  
2. **Type of vaccine** (recombinant, attenuated, or inactivated) being recommended.

**Attenuated Vaccines + Recombinant CDV Vaccine**

If protocol involves administration of an attenuated vaccine (or the recombinant CDV vaccine), a single dose is expected to immunize, if administered in the absence of maternally derived antibody (MDA).

The challenge is determining when MDA levels no longer interfere with immunization in the individual patient. In most dogs and cats, MDA is expected to decline to noninterfering levels by 16 weeks of age. Common scenarios include:

- A puppy receives a single (combined) dose of core vaccines at 7 weeks of age; however, the puppy isn’t returned for the second dose until 9 weeks later, at 16 weeks of age.
Administration of a single dose of a recombinant or attenuated vaccine is expected to immunize.

Alternatively, administration of 2 additional doses, 2 to 6 weeks apart, rather than 1, would also be considered appropriate.

- A dog or cat older than 16 weeks of age is presented to the practice for the first time.
- Surveys of veterinarians practicing in the U.S. and Canada indicate that 2 doses, 2 to 6 weeks apart, are conventionally recommended.

Inactivated Vaccines + Recombinant Noncore Vaccines

When administering inactivated vaccines or recombinant noncore vaccines (eg, leptospirosis, Lyme borreliosis, FeLV), 2 initial doses are required to induce protective immunity, regardless of patient’s age at time the first dose is administered.

- The primary immune response following administration of the first dose of an inactivated vaccine (or recombinant FeLV or Lyme borreliosis vaccine) is relatively weak and short-lived (sometimes referred to as priming).
- A patient that receives only a single dose of inactivated vaccine is unlikely to develop a sustained protective immune response.
- Rabies vaccination is the obvious exception.

- The secondary immune response following administration of the second (immunizing) vaccine dose is relatively robust and has rapid onset (anamnestic).
- This protective immune response is sustained for months or years.  

Protective immunity is expected to develop by 7 days following administration of the second dose of an inactivated vaccine.

The interval between the first (priming) and second (immunizing) doses of an inactivated vaccine is important: If the interval between the initial 2 doses is inordinately prolonged, the anamnestic response to the second dose may be significantly diminished, leaving the patient susceptible if exposed.

During the initial series, using a noncore vaccine, any patient with a vaccination interval that exceeds 6 weeks between doses should receive 2 additional doses, 2 to 6 weeks apart. Common examples include:

- A kitten receiving the first dose of an FeLV vaccine at 10 weeks of age that returns 2 months later for the second dose.
- A dog presenting for its first dose of Lyme borreliosis vaccine (inactivated or recombinant) at 3 years of age that returns 3 months later for the second dose.

See Tables 2 and 3 (pages 27 and 28) for a summary of recommendations for puppies and kittens overdue for vaccination during initial (juvenile) series.

With the exception of rabies, the decision to revaccinate a dog or cat annually versus triennially is left to the discretion of the clinician.

**TABLE 4. Vaccination Recommendations: Adult Dogs Overdue for Scheduled Revaccination**

<table>
<thead>
<tr>
<th>VACCINE TYPE</th>
<th>OVERDUE</th>
<th>RECOMMENDATION</th>
</tr>
</thead>
</table>
| Canine adenovirus-2 (attenuated) | Overdue if more than 3 years since previous dose. | • Administer single dose.  
• Revaccinate every 3 years thereafter. |
| Canine distemper (attenuated) rCanine distemper (recombinant) | | |
| Canine parainfluenza virus (attenuated, parenteral) | | |
| Canine parovirus-2 (attenuated) | | |
| B. bronchiseptica + parainfluenza (attenuated, intranasal) | Overdue if more than 1 year since previous dose. | • Administer single dose.  
• Revaccinate annually. |
| B. bronchiseptica (attenuated, oral or intranasal) | Overdue if more than 1 year since previous dose. | • Administer single dose.  
• Revaccinate annually. |
| B. bronchiseptica (inactivated, parenteral) | Overdue if more than 2 years since previous dose. | • Administer 2 doses, 2–6 weeks apart.  
• Option: Administer single dose of intranasal or oral vaccine.  
• Revaccinate annually. |
| All other noncore vaccines (inactivated; also recombinant Lyme vaccine) | Overdue if more than 2 years since previous dose. | • Administer 2 doses, 2–6 weeks apart.  
• Revaccinate annually or as recommended by manufacturer. |
| Rabies (inactivated) | Overdue if more than 3 years since administration of a labeled 3-year vaccine; or, if more than 12 months since administration of a labeled 1-year vaccine. | • Administer single dose.  
• Revaccinate every 1 or 3 years thereafter if using labeled 1- or 3-year vaccine, respectively.  
• State, local, or provincial statutes may dictate required vaccination schedule. |
Overdue for Adult Revaccination

When considering an alternative vaccination schedule for adult dogs and cats overdue for a vaccine dose, the same principles for a patient overdue during the initial series apply: the elapsed time since the previous vaccine and type of vaccine (recombinant, attenuated, or inactivated) must be considered.

Core Vaccines

Dogs or cats can be considered overdue for revaccination with core vaccines if the last dose was administered over 3 years ago. With the exception of the 1-year rabies vaccine, this recommendation applies to all core vaccines regardless of manufacturer.

Because most core vaccines currently recommended are attenuated (or recombinant CDV), a single dose of a combination vaccine is expected to induce a protective immune response in a patient regardless of the number of years since the previous dose.

Noncore Vaccines

Recommendations for adult dogs overdue for an inactivated noncore vaccine vary somewhat depending on the antigen. Killed bacterial vaccines (bacterins), for example, tend to have a shorter duration of immunity and shorter immune memory compared to killed viral vaccines.

Bacterial vaccines. Generally, an adult dog or cat is considered overdue for an inactivated noncore bacterin (eg, leptospirosis, *Chlamydia felis*) if the last dose was administered 2 or more years previously. These patients should receive 2 doses, 2 to 6 weeks apart, to reinstate protective immunity.

Viral vaccines. Because the immunizing antigen is an inactivated virus as opposed to bacteria, a single dose of vaccine is expected to boost immunity in a patient that has received a dose within the past 3 years (although there are no published studies to confirm this). However, dogs and cats overdue for noncore viral vaccines by 2 or more years should receive 2 doses, 2 to 6 weeks apart.

See Tables 4 (page 29) and 5 for a summary of recommendations for adult dogs and cats that are considered overdue for revaccination.

Overdue for Rabies Vaccination

Although rabies vaccination of dogs or cats is not required by all states or provinces, current vaccination guidelines recommend rabies vaccine as core for dogs and cats. This recommendation is based on the facts that:

- Rabies is a potentially fatal zoonotic disease.
- If an unvaccinated (or overdue for vaccination) dog or cat is exposed to a rabid animal or bites a human, the animal may be subjected to extended quarantine periods and, in some cases, euthanasia.

Veterinarians seeking legal guidance from a state or province on revaccination of dogs and cats overdue for rabies inoculation may have difficulty finding specific recommendations. When guidance is provided, recommendations may vary from state to state, as well as from city to city within a state. Veterinarians are encouraged to review applicable rabies vaccination laws, if available, before recommending alternative schedules for overdue patients.

In locations where specific guidance on vaccination of overdue dogs and cats is not published, it is appropriate to
Vaccine Types
• Attenuated (Live): Vaccine created by reducing virulence of a pathogen, while still keeping it viable
• Inactivated (Killed): Vaccine consisting of virus or bacteria particles that are grown in culture; then killed
• Recombinant: Vaccine created using recombinant DNA technology

contact local or state authorities responsible for providing oversight on animal rabies prior to implementing a novel rabies vaccination schedule. For example, the Pennsylvania Department of Agriculture employs veterinarians within the Bureau of Animal Health who can review a proposed vaccination schedule and circumstances surrounding the case.

It should be noted that the following recommendations are applicable only in those locations that do not provide specific guidance to veterinarians on revaccination of dogs and cats overdue for rabies inoculation.

**Initial Vaccination**

- **The initial dose** of rabies vaccine can be administered to dogs and cats as early as 12 weeks of age.
- Most states allow veterinarian discretion in the use of a rabies vaccine labeled as a 1-year or 3-year product when administering the initial dose.
- In most states, a dog/cat is not considered immunized until 28 days from the date of initial inoculation.
- The maximum duration of immunity following initial inoculation of rabies vaccine is 12 months, whether or not a 3-year rabies vaccine was administered.
- If the animal is not revaccinated within 12 months following the initial dose, it is considered unvaccinated and, therefore, overdue, even if the initial dose was a labeled 3-year vaccine.

**Revaccination**

- **Labeled 3-Year Vaccines**: Adult dogs and cats that have previously received 2 doses of rabies vaccine within a 12-month period (initial dose and first booster dose with labeled 3-year vaccine) are considered unvaccinated (overdue), if not revaccinated within 3 years following the booster dose.
- **Labeled 1-Year Vaccines**: If the booster dose administered was a labeled 1-year vaccine, revaccination is required within 12 months for the patient to be considered vaccinated and current.

Generally, the anamnestic response in a previously vaccinated animal is considered to be rapid and protective. A dog or cat is immediately considered vaccinated (protected) following administration of a booster dose.3,8

**Vaccination for Overdue Pets**

Rabies revaccination for a pet that is overdue for a scheduled inoculation raises the question:

- **Administer single dose** of a labeled 3-year rabies vaccine or
- **Administer 2 doses** at a 12-month interval (ie, repeat the initial 2-dose series)?

Sustained immune memory in a pet that has previously been vaccinated against rabies is a significant factor in making recommendations for revaccination of overdue dogs and cats. The ability of a single dose to rapidly induce a significant (protective) anamnestic response justifies the recommendation to administer a single dose to an overdue patient.

However, there are no studies that stipulate how many years a dog or cat may be overdue for a rabies inoculation and still receive immunologic protection if given a single dose. For example:

- A previously vaccinated pet dog residing in Lancaster County, southeastern Pennsylvania, is 5 years overdue for rabies inoculation.
- Considering the endemicity of rabies in Lancaster County, the dog’s risk for exposure to rabid wildlife, and the time since its last rabies inoculation:
  » It would not be unreasonable to recommend repeating a 2-dose series in this patient.
  » It would even be appropriate to recommend a 4-week interval between the 2 doses (rather than 1-year).

References

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