The rapid proliferation of companion animal vaccines, advances in diagnostic and vaccine technology, and concerns over vaccine safety are clearly among the most important issues practicing veterinarians face as we enter the 21st Century. While many would argue that these are already issues, the future promises to be especially challenging as the vaccines we currently use and the protocols we recommend undergo unprecedented review.

The following presentation describes changes in canine vaccination guidelines that are the result of changes in the availability and type of vaccines on the market today. For example, the last 10 years alone has seen a rapid proliferation of companion animal vaccines introduced throughout the world. In North America today, there are approximately 25 types of canine vaccine veterinarians must select from. In order to provide the most rational and effective vaccines to the individual patient, revised recommendations for canine vaccination must be anticipated. The material presented in this article serves as a guide for clinicians willing to consider proposed canine vaccination recommendations as they apply to individual patients.

**Why change?** Is it really necessary to revise vaccination recommendations for dogs? Many would challenge that it is not. After all, vaccination practice over the last 20 years has; in fact, worked well...canine distemper, canine parvovirus, and canine rabies are virtually non-existent among vaccinated dogs. Yet, despite the obvious successes attributable to companion animal vaccination, veterinarians must be willing to at least review, if not revise, vaccination practice standards as new vaccines are introduced and new vaccine technologies are developed. The objective, quite simply, is to administer the most appropriate vaccine(s) at the most appropriate stage of life and to do so with the best product(s) available. What should not occur is complacency with respect to selection and administration of vaccine.

The demand among veterinarians that vaccines be safe, simple to administer, and timesaving has lead to the long-term and widespread use of polyvalent vaccines. Twenty-five years ago, the most commonly used vaccines contained 3 viral antigens (distemper-hepatitis-leptospirosis). Today, vaccines containing 7 or more antigens per dose are routinely administered to dogs. Furthermore, polyvalent vaccines are routinely administered annually with seemingly little regard for the actual risk of infection. **This is a disturbing trend.** Annual administration of polyvalent vaccine implies that each vaccine antigen, whether of bacterial or viral origin, in each polyvalent product induces the same degree of immunity for the same duration in every patient. Immunologically, this makes no sense what so
ever. Depending on the vaccine antigen, dogs are expected to derive protective that persist for as little as a few months to as long as 7 or more years. **Convenience**, rather than **science**, appears to be the driving force behind conventional recommendations listed on vaccine "labels" (product inserts). Depending on the country in which the vaccine is sold, manufacturers may not be required to determine a minimum duration of immunity.

The standard recommendation published on virtually all vaccine labels is that vaccines be administered annually to adult dogs. The veterinary profession for many years has embraced this recommendation. Interestingly, however, for the majority of vaccines administered to dogs today, there are no scientific studies at all establishing a 12-month duration of immunity (DOI). Vaccine efficacy studies for most vaccines in use today challenged vaccinates just 3 to 4 weeks following the last inoculation. The paradigm that adult dogs and cats require annual boosters for all the commonly administered vaccines is being challenged. We simply cannot continue to arbitrarily administer vaccines without regard for the number and type of vaccine antigens in the product and without realistic consideration of the risk of infection facing the individual animal.

**Canine Distemper Virus.** Modified live virus (MLV) vaccines have been most effective in protecting dogs against canine distemper. Inactivated whole viral vaccines are not effective. Vaccination in puppies is usually continued until 16 weeks of age. Dogs older than 12 weeks of age at the time they are presented for initial vaccination should receive at least 2 canine distemper virus (CDV) 2 to 3 weeks apart. The duration of immunity, determined by challenge, to attenuated (modified-live) canine distemper virus is 7 years for vaccines using the Rockport strain of CDV while that for vaccines using the Onderstepoort strain is 5 years.

**Infectious Canine Hepatitis.** Vaccination for canine adenovirus infection, the cause of infectious canine hepatitis (ICH), is usually done in combination with that for distemper and other diseases, beginning at 6 to 8 weeks of age. Attenuated (MLV) adenovirus-2 vaccines are generally used in the United States because of their ability to produce a superior immune response but inactivated products are marketed in many countries. The half-life of maternal antibody to ICH is similar to that for canine distemper virus: approximately 8.5 days. By the time a puppy reaches 14 to 16 weeks of age, maternal antibody is not usually detectable. Vaccination, therefore is typically combined with canine-distemper virus. The initial vaccines can be administered at 6 to 8 weeks of age and every 3 to 4 weeks until reaching 16 weeks of age. Although booster inoculation is recommended annually in adults, challenge studies have demonstrated the duration of immunity is at least 7 years when attenuated canine adenovirus-2 is used as the vaccine antigen.

**Canine Infectious Tracheobronchitis.** Infectious tracheobronchitis, or kennel cough, is a complex clinical infection caused by a number of respiratory pathogens that can infect dogs alone or in combination. Causative viruses include distemper (CDV), adenovirus (CAV-2), parainfluenza virus (CPIV), herpesvirus (CHV), and reoviruses. *Bordetella bronchiseptica* is a recognized bacterial pathogen. The performance of parenterally administered ITB vaccines is quite different from that of intranasally (topically) administered vaccine. Parenterally administered vaccine for ITB provides duration of immunity of up to 7 months or longer depending
on the antigen. It is not known whether parenteral administration of ITB antigens culminates in the development of an effective local (upper respiratory tract) immune response. Maternal antibody will, however, interfere with parenterally administered vaccine. On the other hand, vaccine labeled for intranasal (topical) administration can be administered as early as 3 weeks of age (depending on the product), appears to induce a local immune response that is not interfered with by maternal antibody, and has a relatively rapid onset (3 to 5 days).

**Canine Parvovirus.** Canine parvovirus-2 (CPV-2) vaccines are available as inactivated or MLV products. MLV products offer better protection against shedding of virulent virus following challenge than inactivated vaccines. For this reason, older dogs that will be housed with younger susceptible animals should be vaccinated with MLV vaccines. In case of an outbreak, MLV vaccines should always be used. MLV CPV-2 products are consistently shed in the feces of vaccinated dogs and will infect contact animals and may cause weak positive reactions on fecal parvovirus ELISA tests. Duration of immunity of MLV CPV-2 vaccines is at least 7 years based on challenge studies; over-vaccination with this product occurs regularly. The duration of immunity subsequent to administration of inactivated (killed) CPV products has been shown to protect puppies from challenge for at least 16 months post-vaccination.

**Canine Coronavirus.** Most vaccines licensed for canine coronavirus are inactivated canine coronaviral or feline coronaviral strains. One attenuated (MLV) canine coronaviral product is available in some countries. In the absence of reliable commercial or in-hospital diagnostic assays for canine coronavirus, the prevalence of clinical disease associated with CCV infection in dogs is unknown but is considered to be extremely low, even in high density shelter environments. CCV vaccine is considered to be among the least important vaccines given to dogs today and has been identified by several authors as a vaccine that, quite simply, is not needed. A minimum duration of immunity has not been established for CCV vaccines; during challenge studies, control dogs do not become ill.

**Leptospirosis.** Inactivated Leptospiral vaccines against 4 serovars inactivated serovars (L. canicola, L. icterohaemorrhagiae, L. grippotyphosa, and L. pomona) are available for dogs. However, the absence of global and regional incidence data for canine leptospirosis greatly complicates the decision regarding whether or not vaccination is necessary and which vaccines should be used.

Lyme borreliosis. Commercial inactivated (killed) whole cell bacterins and one recombinant subunit outer surface protein A (OspA) exist in the United States. In Europe, the vaccines are whole cell bacterin. Vaccines have been shown by challenge studies conducted by the manufacturer of the recombinant OspA vaccine to provide a duration of immunity for up to 1 year. Immunization should be given early in life to high risk dogs living in endemic regions.

**Giardiasis** An inactivated adjuvanted vaccine is available for vaccination of puppies and kittens. The first dose can be given as early as 8 weeks of age. Routine annual revaccination is not indicated with this product except in the unusual situation where recurrent
exposure and infection are documented and can not be controlled using conventional hygienic methods. This vaccine does not prevent infection, but has been shown to diminish fecal shedding of the infectious cysts for up to one year.

Canine Vaccination Guidelines-Rb Ford

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Primary Vaccination ≤ 16 Weeks</th>
<th>Primary Vaccination &gt; 16 Weeks</th>
<th>Manufacturers' Booster Recommendation</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Canine Distemper Virus (MLV)</strong></td>
<td>Administer one dose at 2, 3 and 4 months of age.</td>
<td>1 dose</td>
<td>Annually</td>
<td><strong>Highly Recommended</strong>: Despite annual booster recommendations, adult dogs challenged 7 years (Rockborn Strain) and 5 years (Onderstepoort Strain) following MLV vaccination were protected.</td>
</tr>
<tr>
<td><strong>rCanine Distemper Virus (rCDV)</strong> (recombinant)</td>
<td>Administer one dose at 2, 3 and 4 months of age.</td>
<td>2 doses, 3-4 wks apart</td>
<td>Annually</td>
<td><strong>Highly Recommended</strong>: May be used interchangeably with MLV-CDV vaccine. Does not provide &quot;sterile&quot; immunity and may take longer to protect immunologically naïve dogs.</td>
</tr>
<tr>
<td><strong>Distemper-Measles (MLV)</strong></td>
<td>One dose between 6 and 12 wks of age...only. (One MLV-CDV or rCDV vaccine follows D-M at 14 to 16 wks of age)</td>
<td>Not indicated for use in female dogs over 12 weeks of age.</td>
<td>Not Recommended</td>
<td>Optional-Not Recommended for Routine Use. Intended to provide temporary protection in young dogs only. Indicated for use in households/kennels where distemper is a recognized problem. Do not administer to female dogs over 12 weeks of age. Do not administer to ANY dog over 16 weeks of age.</td>
</tr>
<tr>
<td><strong>Canine Adenovirus-1 (CAV-1) (MLV and killed)</strong></td>
<td>2 doses every 3-4 weeks until 12 weeks of age.</td>
<td>2 doses, 3-4 weeks apart</td>
<td>Annual</td>
<td>Not Recommended. Infectious Canine Hepatitis is uncommon in the US. Considering the low (to absent)</td>
</tr>
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</table>
prevalence, the risk of "hepatitis Blue-Eye" reactions, and the fact that CAV-2 will cross-protect against CAV-1, use of vaccines containing CAV-1 are not recommended.

<table>
<thead>
<tr>
<th>Vaccine</th>
<th>Primary Vaccination (Puppy)</th>
<th>Primary Vaccination (Adult)</th>
<th>Manufacturers' Booster Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Canine Adenovirus-2 (CAV-2)</strong> (MLV, killed or MLV-topical)</td>
<td>Administer one dose at 2, 3 and 4 months of age.</td>
<td>1 dose (if using MLV)</td>
<td>Annual</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 doses, 3-4 weeks apart (if using killed)</td>
<td></td>
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</table>

**Comments**

**Recommended.** Demonstrated cross protection against canine hepatitis (CAV-1) and CAV-2, one of the agents known to be associated with infectious tracheobronchitis (ITB). Usually combined with CDV and CAV vaccine. Currently this product is not available as a monovalent vaccine.

Adult dogs challenged 7 years following CAV-2 MLV vaccination were found to be protected against the more virulent CAV-1.

**Parainfluenza Virus (CPIV) (MLV or MLV-topical)**

Administer one dose at 2, 3 and 4 months of age.

1 dose is adequate Annual

**Recommended.** Usually combined with CDV and CAV vaccine. Currently this product is not available as a monovalent vaccine. Parenterally administered vaccine is less effective than topically (intranasal) administered vaccine. DOI by challenge has been shown to be 1 year (unpublished) for topical vaccine.
**Bordetella bronchiseptica**

(killed bacterin)-

Parenteral

6-8 wks of age, then 10-12 wks of age.

2 doses, 2-4 wks apart

Annual

Optional. The parenteral vaccine may be less efficacious than the topical B. bronchiseptica plus parainfluenza virus vaccines in their ability to stimulate a local immune response (upper respiratory tract). DOI is unknown.

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**Bordetella bronchiseptica**

(live avirulent bacterin) +

Parainfluenza Virus (MLV)

Topical (intranasal)

Use Only

Administer a single dose as early as 2 WEEKS OF AGE. (see product literature for specific age recommendations)

Not stipulated-although a single dose is recommended.

Annual

...if not vaccinated within the last 6 months, a booster is recommended 1 wk prior to known exposure (e.g., boarding, showing, etc.)

Optional-Recommended for dogs housed in kennels, shelters, pounds; prior to boarding in kennels. Transient (3-10 days) coughing, sneezing, or nasal discharge occurs in a small percentage of vaccinates. Antimicrobial therapy may be indicated (Rx Doxycycline, 5-7 days) to manage post-vaccination upper respiratory signs (persistent cough and nasal discharge). DOI is believed to be approx. 10 months for *B. bronchiseptica*.

NOTE: Topically administered vaccines for canine infectious tracheobronchitis may provide a superior local immune response compared to parenterally administered vaccines.

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Note: Letter designation "r" preceding the name of the antigen indicates a recombinant vaccine.
**Bordetella bronchiseptica**
(live avirulent bacterin) +
**Parainfluenza Virus** (MLV) + Canine Adenovirus-2 (MLV)

**TOPICAL** (intranasal)

**USE ONLY**

**Canine Parvovirus** (MLV)
Administer one dose at 2, 3 and 4 months of age.

**Canine Parvovirus** (killed)
Administer one dose at 2, 3 and 4 months of age.

**Recommended** for dogs considered to be at risk of exposure to any of the pathogens listed.

NOTE: Topically administered vaccines for canine infectious tracheobronchitis may provide a superior local immune response compared to parenterally administered vaccines.

DOI's as noted above for individual vaccines.

**Highly Recommended**: Although annual boosters are recommended by vaccine manufacturers, studies have shown protection against challenge up to 7 years post-vaccination with MLV vaccine.

**Recommended**. A suitable alternative to the MLV canine parvovirus vaccine.

NOTE: killed parvovirus products are susceptible to maternal antibody interference in puppies as old as 16 wks (or older?).

Although vaccine manufacturers recommend annual boosters, studies have shown protection against
### Borrelia burgdorferi; Lyme borreliosis (killed whole bacterin)

Initial dose may be given at 12 wks of age and a required second dose 3-4 wks later.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Doses</th>
<th>Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual</td>
<td>2</td>
<td>3-4 wks</td>
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</tbody>
</table>

### Borrelia burgdorferi; Lyme borreliosis (recombinant) Outer Surface Protein A (OspA)

Initial dose may be given at 9 wks of age and a required second dose 2-3 wks later.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Doses</th>
<th>Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual</td>
<td>2</td>
<td>2-3 wks</td>
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</tbody>
</table>

### Canine

Every 2-4 wks of age until 12 wks.

<table>
<thead>
<tr>
<th>Frequency</th>
<th>Doses</th>
<th>Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual</td>
<td>1</td>
<td>(if using)</td>
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</tbody>
</table>

**Optional.** Lyme disease has limited regional prevalence. Recommendation for use is limited to dogs with a known high risk of exposure, preferably dogs living in the Northeastern US and the upper mid-west (Wisconsin, Michigan) or perhaps those traveling to endemic areas when the risk of tick exposure is considered to be high. Minimum DOI based on challenge studies is 156 to 207 days.

**Optional.** Lyme disease has limited regional prevalence. Recommendation for use is strictly limited to dogs with a known high risk of exposure, preferably dogs living in the Northeastern US and the upper mid-west (Wisconsin, Michigan) or perhaps those traveling to endemic areas when the risk of tick exposure is considered to be high. Most authors recommend the recombinant Lyme vaccine over the killed bacterin for reasons of safety (believed to be associated with fewer adverse reactions). The minimum DOI for the recombinant vaccine is 1 year, based on challenge.

**Optional.** Prevalence of clinical cases of confirmed canine coronavirus...
Coronavirus
(killed and MLV)

Begin as early as 6 wks. of age; every 2-3 wks with the final dose at 12 wks of age (killed).

- Leptospira interrogans

- Leptospira canicola combined with L. icterohaemorrhagiae

(Also available with)

<table>
<thead>
<tr>
<th>Disease</th>
<th>Age Range</th>
<th>Dose Schedule</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronavirus</td>
<td>12 and 16 weeks.</td>
<td>2 doses, 2-4 wks apart</td>
<td>Annual</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Leptospirosis canicola</td>
<td></td>
<td>Do not administer to dogs less than 12 weeks of age.</td>
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</tr>
</tbody>
</table>

It is recommended that animal shelters NOT utilize coronavirus vaccine in routine vaccination programs due to additional costs incurred by doing so and the lack of benefit. Experience has shown no additional increase in infectious enteritis among adults or puppies subsequent to discontinuing canine coronavirus vaccine.

The DOI for CCV vaccine can not be determined since control dogs that are challenged do not become ill.

Optional. Anecdotal reports from veterinarians and breeders suggest that the incidence of post-vaccination reactions (acute anaphylaxis) in puppies (less than 12 weeks of age) and small breed dogs is high. Reactions are most severe in young (<9 weeks of age) puppies. Routine use of the vaccine should be delayed until dogs are ≥ 9 weeks of age.

NOTE: Disease prevalence is likely to vary for each serovar. Vaccine
### Serovars

- **Grippotyphosa and Pomona**

### Giardia lamblia (killed)

- **Initial dose may be given at 8 wks of age; a second dose should be given 2-3 wks later.**

- **2 doses, 2-3 wks apart**

- **Annual**

### Rabies 1-year (killed)

- **Administer 1 dose as early as 3 mo. of age.**

- **Administer a single dose.**

- **The 1-Year Rabies Vaccine may be used as a booster vaccine when dogs are required to be vaccinated annually against rabies. Local statues apply.**

### Route Of Administration

- **May Not Be Optional—see product literature for details.**

### Recommendations

- Recommendations are therefore difficult to make due to the lack of information on prevalence of specific infections in dogs.

- Minimum DOI based on challenge studies has been shown to be at least 13 to 14 months for serovars L. canicola and L. icterohaemorrhagiae.

- **Not Recommended for Routine Use.**

  - The vaccine will prevent oocyst shedding but does not prevent infection. Although giardiasis is the most common intestinal parasite among people in the US, the source of human infection is contaminated water. Infections in dogs and cats are not likely to be zoonotic.

  - A minimum DOI based on challenge is not reported.

### Route Of Administration

- **Required.** MLV vaccines are not available; State and local statues govern the frequency of administration for products labeled as "1-Year Rabies".

- **NOTE:** The Rabies (1-year) vaccine is generally administered as the initial dose followed, 1 year later, by administration of the Rabies (3-year) Vaccine. State and local statues may
**Rabies 3-year (killed)**

<table>
<thead>
<tr>
<th>Route Of Administration</th>
<th>Note: 3-year rabies vaccine may be used as an alternative to the 1-year Rabies vaccine for initial and subsequent doses. Local statutes apply.</th>
<th>Note: 3-year rabies vaccine may be used as an alternative to the 1-year Rabies vaccine for initial and subsequent doses. Local statutes apply.</th>
</tr>
</thead>
<tbody>
<tr>
<td>May Not Be Optional—see product literature for details.</td>
<td>Administer 1 dose as early as 3 months of age.</td>
<td>The second rabies vaccination is recommended 1-year following administration of the initial dose regardless of the animal's age at the time the first dose is administered. Depending on local statutes, booster vaccines should be administered annually or every 3 years.</td>
</tr>
</tbody>
</table>

**Required.** State and local statutes govern the frequency of administration for products labeled as Rabies (3-year) . . . these statutes vary throughout the U.S.

Note: The Rabies (1-year) vaccine is generally administered as the initial dose followed, 1 year later, by administration of the Rabies (3-year) Vaccine. State and local statutes may dictate otherwise.

Note: Route of administration is SQ or IM unless otherwise noted by the manufacturer

Note: Letter designation "r" preceding the name of the antigen indicates a recombinant vaccine.

**References**


**Speaker Information**

(click the speaker's name to view other papers and abstracts submitted by this speaker)

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Dr. Richard Ford is Professor of Medicine in the Dept. of Clinical Sciences, College of Veterinary Medicine at North Carolina State University. Dr. Ford graduated from Ohio State University after which he practiced small animal and equine medicine. He completed an internal medicine residency at Michigan State University. He has held faculty positions at Purdue University and North Carolina State.

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