

VITAL VACCINATION SERIES

VACCINATION OF CATS AGAINST INFECTIOUS UPPER RESPIRATORY DISEASE

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**Feline
Friendly
Article**

Four vaccines are currently available to aid in the prevention of upper respiratory disease (URD) in cats associated with exposure to (Table 1, page 58):

- Feline herpesvirus-1 (cause of feline rhinotracheitis)
- Feline calicivirus
- *Chlamydomphila felis*
- *Bordetella bronchiseptica*.

None of the feline respiratory vaccines completely prevent infection or development of a carrier state. They do, however, mitigate the severity of respiratory disease. Table 2 (page 60) summarizes feline respiratory disease vaccine types and routes of administration.

However, several important variables influence not only the justification to recommend vaccination but the quality of immunity an individual cat derives following administration of a vaccine.

VIRAL DISEASE AGENTS

Feline Herpesvirus-1

Feline herpesvirus-1 (FHV-1) is the respiratory pathogen that causes the most severe clinical signs in cats.

Clinical Signs. Sneezing, rhinitis (often times ulcerative), tracheitis, conjunctivitis, keratitis, and oral ulceration characterize acute infection (Figure 1). Occasionally, localized skin lesions occur.

Disease Course. Kittens are the most susceptible to exposure, especially as maternally-derived antibody (MDA) levels decline. Cats that survive initial infection develop a latent infection that typically persists for the life of the cat. Cats latently infected with FHV-1 can manifest episodic reactivation of the latent herpesvirus, with viral shedding often following pharmacologic (eg, corticosteroid administration) or physiologic stress.¹



Figure 1. A 5- to 6-week-old kitten infected with feline herpesvirus-1

Feline Calicivirus

Feline calicivirus (FCV) infection is highly prevalent in the feline population. Over 40 strains of FCV have been identified, some of which mutate to become highly virulent, or virulent systemic (VS), FCV strains.

Clinical Signs. Most strains cause acute upper respiratory signs characterized by sneezing and oral/nasal ulceration. Secondary bacterial infections are common and may culminate in pneumonia and death, particularly in kittens. Although uncommon, VS calicivirus can cause edematous and ulcerative skin infections, hemorrhagic syndromes, pancreatitis, jaundice, and high mortality.²

Disease Course. Following recovery from the more common acute FCV infection, cats may develop a chronic carrier state, with persistent viral shedding, lasting from weeks to

TRANSMISSION OF FELINE UPPER RESPIRATORY DISEASE

Transmission of feline URD, whether viral or bacterial in origin, most often occurs following direct cat-to-cat contact with infected nasal, ocular, or oral secretions.^{1,3} Indirect contact with contaminated sources (feeding dishes, clothing, hands) also transmits these diseases. Transmission through aerosolized microdroplets from infected cats can occur over short distances (less than 3–4 feet), but is not regarded as a primary route.⁴

years. Chronic carrier cats may manifest paroxysmal sneezing, nasal discharge, or chronic gingivitis/stomatitis (**Figure 2**). Some affected cats have no clinical signs but shed virulent virus continuously from the oropharynx, posing a significant risk to susceptible cats/kittens.

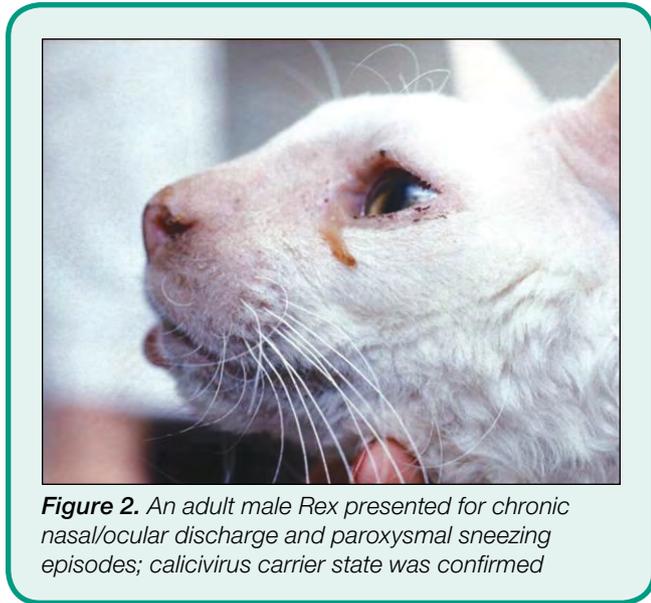


Figure 2. An adult male Rex presented for chronic nasal/ocular discharge and paroxysmal sneezing episodes; calicivirus carrier state was confirmed

BACTERIAL DISEASE AGENTS

Chlamydophila felis

Chlamydophila felis, a gram negative intracellular bacterium, is a minor pathogen in the spectrum of agents that cause feline infectious URD.

Clinical Signs. Although sneezing and nasal discharge can occur during infection, conjunctivitis with chemosis and mucoid ocular discharge are the most common clinical manifestations (**Figure 3**).

Disease Course. Clinical signs typically develop 5 to 10 days following exposure. Chronic carrier cats have been identified.

Bordetella bronchiseptica

Bordetella bronchiseptica, a gram negative bacterium, has adapted to the respiratory tract of several species, including humans, and exists as part of the normal respiratory flora of many cats and dogs.

Clinical Signs. Clinical signs of feline bordetellosis are characterized by cough and, occasionally, bronchopneumonia. Ocular and nasal discharge have also been observed.

Disease Course. For yet undetermined reasons, *B bronchiseptica* is able to up-regulate a virulence gene complex, resulting in the release of potent toxins capable of causing severe upper and lower respiratory disease in dogs and cats.⁵ Kittens, especially those co-infected with feline viral

TABLE 1. FELINE UPPER RESPIRATORY INFECTIONS CONTROLLED BY VACCINATION

PREVALENCE	TRANSMISSION	ZOONOTIC RISK
Feline Herpesvirus-1 (double-stranded DNA virus)		
Highly prevalent as a latent virus	<ul style="list-style-type: none"> • Direct cat-to-cat contact • Virus survives up to 18 H in external environment • Carrier state develops following infection • Virus highly susceptible to common disinfectants 	Feline infections are not zoonotic
Feline Calicivirus (single-stranded RNA virus)		
Highly prevalent	<ul style="list-style-type: none"> • Direct cat-to-cat contact • Virus survives for days to weeks in external environment • Carrier state can develop following infection • Virus most susceptible to household bleach:water (1:30) 	Feline infections are not zoonotic
<i>Chlamydophila felis</i> (gram-negative, obligate intracellular bacterium)		
<ul style="list-style-type: none"> » Low prevalence in household cats » Slightly higher prevalence in high-density populations 	<ul style="list-style-type: none"> • Direct cat-to-cat contact • Bacterium can survive only a few days in external environment (room temp) • Carrier-states recognized in cats, with shedding from reproductive tract of adult cats following ocular infection 	Feline infections have been implicated, but not well documented, in connection with human conjunctivitis
<i>Bordetella bronchiseptica</i> (gram-negative coccobacillus)		
Relatively prevalent	<ul style="list-style-type: none"> • Bacterium exists in a nonpathogenic state in respiratory tract of cats and dogs • Transmission occurs following direct cat-to-cat contact; aerosol transmission less likely 	Minor zoonotic risk*

* Opportunistic human infections have been reported following contact with infected dogs



Figure 3. Conjunctivitis and chemosis in an adult female cat confirmed to have *Chlamydomphila felis*

URD (FVURD), may develop fatal complications associated with pneumonia. In contrast, primary bordetellosis in adult cats appears to be uncommon.¹

CORE VACCINES

Vaccine Types

Three types of combination FHV-1 plus FCV vaccine are available; an inactivated, bi-valent FCV vaccine is also available. Most vaccines sold in the U.S. and Canada are combined with other vaccines (eg, feline parvovirus or feline leukemia).

- Modified-live virus (nonadjuvanted) vaccine is recommended over killed virus products for routine use.
- Use of killed (adjuvanted) virus vaccine is reserved for use in pregnant queens, retrovirus positive cats, or in high-density populations, where there is minimal evidence of respiratory disease.⁶
- An inactivated (adjuvanted) bi-valent vaccine, which contains 1 conventional respiratory virus strain plus 1 strain of VS calicivirus, is available in the U.S. and Canada. A study published by the manufacturer has shown that vaccinated cats developed reduced clinical signs following challenge with a homologous FCV strain.³ Additional studies are needed before this vaccine can be recommended for routine use.
- Onset of immunity following intranasal (IN) vaccination may be faster (by a few days) than that of parenteral (MLV) vaccination.
- IN vaccines immunize at an earlier age because there is less MDA interference in the upper respiratory tract.

Recommended Protocol: Kittens

- A combination feline parvovirus (FPV), FHV-1, and FCV vaccine is recommended for all cats, beginning as early as 6 to 8 weeks of age, regardless of vaccine type.
- Kittens should receive an additional dose every 3 to 4 weeks until 16 to 20 weeks of age.
- The extended vaccination age (16–20 weeks) for kittens is intended to avoid interference from MDA associated with FPV.

Why does FVURD continue to pose such a significant threat to the feline population if vaccination against these virus infections is routine and widespread?

First, both FHV-1 and FCV are readily transmitted when infected cats are housed with susceptible cats. Second, FHV-1 and FCV vaccines currently sold in the U.S. and Canada do not provide “sterile” immunity.

What is sterile immunity?

The immunity a cat derives from vaccination does reduce the severity of clinical signs subsequent to exposure and infection; it does not, however, prevent infection nor does it prevent development of a carrier state and viral shedding.¹ The immune response to both FHV-1 and FCV vaccination is, therefore, deemed “non-sterile” (regardless of the product used and route of administration). In contrast, the immune response subsequent to feline parvovirus (panleukopenia virus) vaccination is considered “sterile”; vaccinated cats receive protection from both infection and clinical disease if exposed.

How do you reduce the risk for infection?

As long as the number of cohoused cats remains low, exposure risk is low, and vaccination offers satisfactory protection. However, as the number of cats within a household increases, the risk that chronic virus carrier (viral shedding) cats will be introduced also increases. Vaccinated cats, if exposed, become infected and are likely to become chronic virus carriers. Susceptible, nonvaccinated cats, on the other hand, will become infected and develop the full spectrum of clinical signs of acute-onset upper respiratory infection.

To what degree is FVURD prevalent in the feline population?

Chronic virus carrier cats are highly prevalent in the population and disease is endemic in high-density populations. In addition, shelter-housed cats and those residing in rescue facilities have high infection rates despite routine vaccination. As the proportion of young, susceptible kittens within the population increases, the risk for serious clinical disease can be expected to increase as well.

Management of infectious respiratory disease in high density populations is complicated by the following:

- Adequately designed and maintained quarantine facilities are uncommon; the expense of constructing proper facilities with adequate ventilation, combined with high numbers of entrant cats received at certain times of year, make isolation impractical or ineffective.
- Segregating healthy, virus-free cats from healthy, virus-carrier cats requires virus isolation and time; neither option is practical in high-density, high-turnover environments.
- Strict vaccination at the time of intake, either by parenteral or IN routes, is unlikely to prevent infection or development of a virus-carrier state following exposure.

TABLE 2. FELINE UPPER RESPIRATORY DISEASE VACCINES

VACCINE	TYPE	ROUTE
Herpesvirus-1 (FCV-1) + calicivirus (FCV)	Modified-live virus; nonadjuvanted	Subcutaneous
Herpesvirus-1 (FCV-1) + calicivirus (FCV)	Killed virus; adjuvanted	Subcutaneous
Herpesvirus-1 (FCV-1) + calicivirus (FCV)	Modified-live virus; nonadjuvanted	Intranasal (mucosal)
Bi-valent calicivirus (FCV)	Killed virus; adjuvanted	Subcutaneous
<i>Bordetella bronchiseptica</i>	Avirulent, live bacteria; nonadjuvanted	Intranasal ONLY
<i>Chlamydomphila felis</i>	Avirulent, live bacteria; nonadjuvanted	Subcutaneous
<i>Chlamydomphila felis</i>	Killed bacteria; adjuvanted	Subcutaneous

Recommended Protocol: Adult Cats

- All cats should be revaccinated 1 year following completion of the initial series.
- Revaccination no more often than every 3 years is recommended for household pet cats living in low-density environments.
- Annual revaccination is indicated for cats housed in high-density environments, where risk for exposure to respiratory disease is high.

Limitations

FVURD continues to represent a significant health threat to the feline population. Mortality is typically low among infected cats, especially if supportive medical therapy is available. Morbidity, on the other hand, is particularly high...*despite routine vaccination.*

Cats housed in high-density environments are at significant risk for infection. Individuals responsible for the management of these populations face significant financial risk associated with treating large numbers of affected cats or the need to depopulate.

NONCORE VACCINES

Vaccine Types

Both inactivated (killed, adjuvanted) and attenuated (avirulent live, nonadjuvanted) vaccines are available as an aid in preventing clinical signs associated with *Chlamydomphila felis* (formerly, *Chlamydia psittaci*) infection.

One vaccine is currently available as an aid in the prevention of *Bordetella bronchiseptica* infection in cats. The product is an avirulent live bacterin (monovalent, non-adjuvanted) approved for IN administration only (no parenteral administration). Cats should not receive the canine *B bronchiseptica* vaccine because its constituency is different than that of the feline *B bronchiseptica* vaccine.

Recommended Protocol: *Chlamydomphila felis*

- *C felis* vaccines are typically combined with various other vaccines.
- Indications for administering vaccine are generally limited to cats residing in multiple-cat households, where the risk for exposure to *C felis* has been confirmed.

- If indicated, 2 initial doses should be administered 3 to 4 weeks apart; annual vaccination is recommended for cats in which the risk for exposure is sustained.

Recommended Protocol: *Bordetella bronchiseptica*

- Indications for vaccinating cats against *B bronchiseptica* are generally limited to high-density housing environments, where the risk for exposure to infected cats or dogs is known.
- Kittens appear to be at greatest risk, especially if coinfecting with FHV-1 or FCV.
- A single dose (0.2 mL), administered into 1 nostril, can be administered as early as 8 weeks of age; annual revaccination is recommended for cats at risk for exposure.

Limitations

Cats are not expected to develop protective (sterile) immunity following vaccination against either *C felis* or *B bronchiseptica*.⁷ Vaccination is only expected to mitigate, not prevent, clinical signs.

Furthermore, the prevalence of clinical disease associated with *C felis* appears to be relatively low in the U.S. and Canada, especially among household cats. Determining risk for infection among individual cats, however, is complicated by the paucity of epidemiologic studies. Estimates of infection range from 10% to 30% of cats with upper respiratory signs; *C felis* has been recovered from a small percentage of cats without clinical signs.⁸

B bronchiseptica can be recovered as part of the normal bacterial flora from the respiratory tract of healthy cats. The role of *B bronchiseptica* as a single-agent infection in cats with respiratory disease has not been determined; therefore, it is particularly difficult to assess disease risk and indications for vaccination.

The limitations cited justify categorizing these vaccines as noncore. Additionally, both *C felis* and *B bronchiseptica* are susceptible to doxycycline (10 mg/kg Q 24 H, or 5 mg/kg Q 12 H, PO for 7–10 days), which can be administered to treat an active infection.

PREVENTION & MANAGEMENT

Vaccination

Despite the limitations outlined, all cats should receive the initial series of vaccines against FHV-1 and FCV. The

VACCINE PRIMER

Adjuvant: A chemical, microbial, constituent, or mammalian protein commonly added to killed (inactivated) vaccine to enhance the immune response to a selected antigen.

Attenuated (avirulent live and modified-live): Vaccine that contains the live virus or bacteria as the immunizing antigen. The virulence of the organism (antigen) is reduced, but is still capable of infecting cells and replicating following inoculation.

Killed, or inactivated: Vaccine that contains killed virus or bacteria as the immunizing antigen; following inoculation, the antigen is incapable of infecting cells or replicating.

revaccination interval varies depending on the exposure risk of the individual cat:

- Cats living inside and in households with low population density can be protected if revaccinated every 3 years.
- Cats residing in high-density populations are likely to have a high exposure risk and should be revaccinated annually.

The recommendation to vaccinate against *C. felis* or *B. bronchiseptica* should, on the other hand, be limited to:

- Households, where infection, and associated clinical signs, has been confirmed
- Cats, especially kittens, residing in high-density populations (shelter-housed cats, breeding colonies).

Vaccination of individual household cats living in low-density environments is unlikely to be necessary, and veterinarians should use discretion when recommending vaccination against chlamydiosis and bordetellosis.

High-Density Populations

Physical separation of vaccinated cats from nonvaccinated cats and, when feasible, separating cats with a known history of respiratory disease is important in reducing the risk of exposing healthy cats to chronic carrier cats. Also, separating susceptible kittens from the adult (chronic virus carrier) population is fundamental in reducing the incidence of acute infections, particularly with FHV-1 and FCV.

Feeding

Within high-density populations, feeding should be ordered in such a way that healthy cats are fed first and cats with signs of upper respiratory disease are fed last. Ideally, disposable gloves should be used between cats or between cages of cohoused cats. Disposable feeding bowls should also be used; however, if using washable food bowls, soak bowls in fresh solution of 1 part household bleach to 30 parts water (1:30). Allow bowls to thoroughly dry before using.

Ventilation

Adequate ventilation, defined as 16 air exchanges per hour, is important to:

- Reduce the concentration of virus within the environment
- Maintain a healthy population. ■

FCV = feline calicivirus; FHV-1 = feline herpesvirus-1; FPV = feline parvovirus; FVURD = feline viral upper respiratory disease; IN = intranasal; MLV = modified-live virus; MDA = maternally-derived antibody; URD = upper respiratory disease; VS = virulent systemic

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