
General Principles
- All cats should be tested for infection with feline leukemia virus (FeLV) and feline immunodeficiency virus (FIV).
- Cats infected with FeLV or FIV may live for many years. A decision for euthanasia should never be made solely on the basis of whether a cat is infected.
- A confirmed positive test result should be considered only an indication of retrovirus infection, not clinical disease. Diseases in cats infected with FeLV or FIV may not necessarily be a result of retrovirus infection.
- No test is 100% accurate at all times and under all conditions. Therefore, all test results should be interpreted in light of the patient’s health and prior likelihood of infection.

Feline Leukemia Virus
- FeLV infection occurs worldwide, with prevalence varying by location. FeLV is associated with illness in and death of more cats than any other infectious agent.
- The most effective way to prevent infection is to prevent exposure to FeLV-infected cats. Testing to identify infected cats is the mainstay of preventing transmission of FeLV. FeLV vaccination should not be considered a substitute for testing cats.

Cats should be tested for FeLV infection in the following circumstances:
- Whenever they are sick, regardless of age, negative results of previous FeLV tests, and FeLV vaccination status. FeLV infection has been associated with a wide variety of diseases including, but not limited to, anemia, neoplasia, and disorders associated with immune dysfunction. Although FeLV infection may influence patient management and prognosis, treatment decisions should not be made solely on the basis of whether a cat is infected.
- When they are about to be adopted, regardless of age.
- Cats should be tested before being introduced into a multiple-cat household to prevent exposing resident cats.
- Cats should be tested before being introduced into a household even if no other cats are present in the household at the time of adoption, for the following reasons:
  - FeLV infection may have future health ramifications, even if the cats do not presently have any signs of disease.
  - Additional cats may join the household.
  - Cats intended to be housed exclusively indoors may escape and expose other cats.
- When results of the most recent test are negative,
but recent exposure cannot be ruled out. Cats in this situation should be retested a minimum of 28 days after the last potential exposure, because test results may be negative during the pre-viremic stage of infection. If the time of the cat’s last potential exposure is unknown, clients should be counseled on the potential risk of exposing other cats in a FeLV-negative household when adding a cat for which results of a single test were negative.

- When FeLV infection status is unknown. Infected cats may remain asymptomatic for years, during which time they may serve as inapparent sources of infection to other cats in the household.
- When they are exposed, or potentially exposed, to cats of unknown infection status (e.g., cats that go outdoors unsupervised), regardless of whether they have been vaccinated against FeLV. Periodic testing may be justifiable in cats at continued risk of exposure even though adults are relatively resistant to FeLV infection.
- When they are about to be vaccinated against FeLV.
- FeLV vaccines should not be administered to infected cats. FeLV vaccination does not affect the carrier state, the capacity to infect other cats, or the development of disease in cats with pre-existing infection. Vaccination may also be associated with adverse events.
- Cats infected prior to FeLV vaccination may appear to be vaccination failures.

**Test selection**

- The preferred initial tests are soluble antigen tests, such as ELISA and other immunochromatographic tests (tests in which color is generated as a result of an immunologic reaction), that detect free antigen in fluid. Soluble antigen tests are most reliable when serum or plasma, rather than whole blood, is tested. In experimental settings, most cats will have positive results with soluble antigen tests within 28 days after exposure; however, the time between exposure and development of antigenemia is extremely variable and may be considerably longer in some instances. Tests using saliva or tears yield an unacceptably high percentage of inaccurate results and their use is not recommended.
- Indirect immunofluorescent antibody (IFA) tests detect cell-associated antigen.
- Polymerase chain reaction (PCR)-based assays that detect viral RNA or DNA, offer a promising approach to FeLV testing. However, reagents and testing protocols are neither standardized nor validated.

**Test interpretation**

- No test is 100% accurate at all times and under all conditions. In populations with a low prevalence of FeLV infection, more than half of cats for which test results are positive are likely to be uninfected. Confirming positive test results is crucial, especially in asymptomatic cats.
- Negative test results are much more reliable than positive results, because of the low prevalence of infection in most populations.
- To increase the reliability of a positive soluble antigen test result, the test may be repeated, using a different type of test, such as an IFA test, or another immunochromatographic test.
- Positive results obtained with tests that detect free antigen may be reflective of transient or persistent viremia.
- Positive results obtained with tests that detect cell-
associated antigen (e.g., IFA test) are highly likely to be reflective of persistent viremia.²

- Discordant test results are defined as conflicting results obtained with different tests. Discordancy may be a consequence of the stage of infection, the variability of host response, or technical problems with the testing system.
- If results of two soluble antigen tests are discordant, an IFA test should be performed immediately.
- If results of a soluble antigen test and an IFA test are both positive, the cat is highly likely to be persistently infected.
- If results of a soluble antigen test are positive and results of an IFA test are negative, both tests should be performed again in 60 days and then annually until results of both tests are in agreement. It is very difficult to determine the true infection status as long as discordancy remains, but cats with discordant results should be considered potential sources of infection for other cats.
- Because FeLV tests detect antigen rather than antibody, maternally derived antibodies do not influence results of FeLV tests. Therefore, kittens may be tested at any age. However, infection in newborn kittens may not be detected until weeks to months after birth.¹
- FeLV vaccination will not induce positive test results.

Feline Immunodeficiency Virus

- FIV infection occurs worldwide, with prevalence varying by location.¹⁰
- The only way to prevent infection is to prevent exposure to FIV-infected cats. Testing to identify infected cats is the mainstay of preventing viral transmission.

Cats should be tested for FIV infection in the following circumstances:

- Whenever they are sick, regardless of negative results of previous FIV tests. FIV infection has been associated with a wide variety of disorders including, but not limited to, stomatitis, bone marrow dyscrasias, neoplasia, ocular disease, central nervous system disease, and other disorders associated with immune dysfunction.¹¹ Although FIV infection may influence patient management and prognosis, treatment decisions should not be made solely on the basis of whether a cat is infected.
- When they are about to be adopted, regardless of age.
- Cats should be tested before being introduced into a multiple-cat household to prevent exposing resident cats.
- Cats should be tested before being introduced into a household even if no other cats are present in the household at the time of adoption, for the following reasons:
  - FIV infection may have future health ramifications, even if the cats do not presently have any signs of disease.
  - Additional cats may join the household.
  - Cats intended to be housed exclusively indoors may escape and expose other cats.
- When results of the most recent test are negative, but recent exposure cannot be ruled out. Cats in this situation may be retested a minimum of 60 days after the last potential exposure to allow time for seroconversion. If the time of the cat’s last potential exposure is unknown, clients should be counseled on the potential risk of exposing other cats in a FIV-negative household when adding a cat for which results of a single test were negative.
- When FIV infection status is unknown. Infected cats may remain asymptomatic for years, during which time they may serve as inapparent sources of infection to other cats in the household.
- When they reside with FIV-infected cats. Annual testing of such cats is recommended.
- When they have a history of unsupervised outdoor activity or of residing in households with cats of unknown infection status. Periodic testing of such cats is justifiable.
- When they have been potentially exposed, such as through a bite inflicted by a cat of unknown infection status. Such cats should be tested a minimum of 60 days after exposure.
Test selection

• Currently available FIV tests (ELISA, Western blot test, and other immunochromatographic tests) detect antibodies directed against the virus. Most cats develop antibodies to FIV within 60 days after infection. However, the time required for seroconversion is extremely variable and may be considerably longer than 60 days in some instances.

• ELISA and other immunochromatographic tests, except Western blotting, are the preferred screening tests. All positive screening test results should be confirmed by use of the Western blot test. If Western blot testing is not available, a second test using a different type of test may be performed.

• Polymerase chain reaction (PCR)-based assays that detect viral RNA or DNA offer a promising approach to FIV testing. However, reagents and testing protocols are neither standardized nor validated.

Test interpretation

• No test is 100% accurate at all times and under all conditions. In populations with a low prevalence of FIV infection, more than half of cats for which test results are positive may be uninfected. Confirming positive test results is crucial, especially in asymptomatic cats.

• Negative test results are much more reliable than positive results, because of the low prevalence of infection in most populations.

• There is a high correlation between the detection of antibodies and persistent infection, because infection with FIV is lifelong.

• Maternally derived antibodies to FIV in kittens younger than 6 months of age confound interpretation of positive test results. Kittens born to infected queens may test positive for antibody, yet most will not be infected. To clarify infection status, kittens for which results of tests performed before 6 months of age are positive should be retested at 60-day intervals. If results of tests performed after 6 months of age are still confirmed positive, these kittens should be considered infected. Even kittens that initially test positive yet become seronegative prior to 6 months of age have likely been exposed, and consideration should be given to re-testing a minimum of 60 days after the last potential exposure.

Management of FeLV- and FIV-Positive Cats

Identification of FeLV or FIV status

All cats should be tested for FeLV and FIV infection. This is particularly important for cats in multiple-cat households, but is also important for cats in single-cat households, because either of these retroviral infections may impact a cat’s health status and long-term management. Both FeLV and FIV infection cause immunosuppressive diseases, and although there are differences in the direct specific effects of each virus, most health problems in retrovirus-positive cats are due to secondary diseases caused by immunosuppression.

Although some older literature suggested that FeLV-infected cats live a maximum of three years after diagnosis, this appears to relate mainly to cats living in multiple-cat households in which FeLV is endemic. With proper care, FeLV- and FIV-infected cats often live longer than this and, in fact, may die of causes unrelated to retroviral infection. A decision to treat or euthanatize a cat should never be made solely on the basis of whether the cat has a retroviral infection.

Preventing transmission of FeLV and FIV in households

FeLV infection is primarily a concern for cats that are friendly with other cats, as close, intimate contact between cats is required for transmission. This type of contact occurs among cats as a result of mutual grooming and sharing of food bowls, water bowls, and litter pans. Transmission by biting can occur, but this is an infrequent mode of infection. If an FeLV-positive cat is identified in a household, the best method of preventing spread to other cats in the household is to isolate the infected cat in a separate room and prevent the infected cat from interacting with its housemates. There is strong, natural, age-related resistance to FeLV infection in adult cats.

Kittens less than year of age are at a greater risk of
infection than are adults. If owners choose not to separate housemates, uninfected cats should be vaccinated against FeLV in an attempt to enhance their natural level of immunity. However, it should be understood that FeLV vaccines do not necessarily protect all cats against FeLV infection. FeLV can be transmitted vertically from an infected queen to her kittens in utero or via infected milk. Infected queens should not be bred and should be spayed if their condition is sufficiently stable to permit them to undergo surgery.

FIV infection is primarily a concern for cats that are unfriendly with other cats, as the major mode of transmission is through bite wounds. Generally, cats in households with stable social structures where housemates do not fight are at little risk for acquiring FIV infection. However, separation of infected cats from uninfected housemates is recommended to eliminate the potential for FIV transmission. Experimentally, FIV has been shown to be vertically transmitted by infected queens to their kittens. Although this is apparently true only for a few specific strains of FIV, infected queens should not be bred and should be spayed if their condition is sufficiently stable to permit them to undergo surgery.

Preventing transmission of FeLV and FIV in veterinary hospitals

As with many enveloped viruses, retroviruses are labile outside their host animals and are rapidly inactivated by detergents and routine disinfectants. Therefore, simple precautions and routine cleaning procedures will prevent transmission of these agents in veterinary hospitals. All FeLV- and FIV-infected patients should be housed in individual cages and may be maintained in this manner in the general hospital population. Animal caretakers and other hospital staff members should wash their hands between patients and after handling animals and cleaning cages. Both FeLV and FIV can be transmitted hematogenously; therefore, all feline blood donors should be tested for and confirmed to be free from infection before donating blood. Dental and surgical instruments, endotracheal tubes, and other items potentially contaminated with body fluids should be thoroughly cleaned and sterilized between uses. Fluid lines, multi-dose medication containers, and food can become contaminated with body fluids (especially blood or saliva) and should not be shared among patients.

Routine wellness care for FeLV- and FIV-infected cats

Cats infected with FeLV, FIV, or both should be confined indoors to prevent spread to other cats in the neighborhood and exposure of affected cats to infectious agents carried by other animals. As for all cats, good nutrition and husbandry are essential to maintaining good health in FeLV- and FIV-infected cats. These cats should be fed a nutritionally balanced and complete feline diet. Raw meat and eggs and unpasteurized milk should be avoided, because the risk of food-borne bacterial and parasitic infections is greater in immunosuppressed individuals. A program for routine control of gastrointestinal parasites, ectoparasites, and heartworms, where applicable, should be implemented.

FeLV- and FIV-infected cats should receive wellness visits at least semi-annually to promptly detect changes in their health status. Veterinarians should obtain a detailed history to help identify problems requiring more intensive investigation and perform a thorough physical examination at each visit. Special attention should be paid to the oral cavity, because dental and gum diseases are common in affected cats. Lymph nodes should be identified and carefully evaluated for changes in size and shape. Ocular lesions are particularly common in FIV-infected cats, but all cats should receive a thorough examination of the anterior and posterior segments of the eye. The skin should be examined closely for evidence of external parasitic infestations and fungal diseases. The body weight should be accurately measured and recorded, because weight loss is often the first sign of deterioration in a cat’s condition.

A complete blood count should be performed yearly for FIV-infected cats and at least semi-annually for FeLV-infected cats, because of the greater prevalence of virus-related hematologic disorders in
FeLV-infected cats. Serum biochemical analyses and urinalyses should be performed yearly; urine samples should be collected by means of cystocentesis so that bacterial cultures can be performed, if necessary. Fecal examinations should be considered for cats with a history of possible exposure to internal parasites or with a history of gastrointestinal tract disease.

Vaccination programs to prevent common, serious infectious diseases should be maintained. In general, vaccination programs for FeLV- and FIV-infected cats should be similar to those for uninfected cats. Rabies vaccines should be given in accordance with state and local regulations. Feline viral rhinotracheitis-calicivirus-panleukopenia vaccines should be given in accordance with the AAFP guidelines (ie, routine primary vaccination, followed by a booster vaccination 1 year later and every 3 years thereafter). Some clinicians recommend that only killed virus vaccines be used in FeLV- and FIV-infected cats. However, there is little evidence that such cats are at increased risk of adverse effects with modified-live virus vaccines. FeLV vaccines are of no benefit in and should not be given to FeLV-infected cats. Other vaccines should be evaluated carefully before being administered.

Sexually intact male and female cats should be neutered to reduce stress associated with estrus and mating behaviors. Neutered animals are also less likely to roam outside the house or interact aggressively with their housemates. Surgery is generally well tolerated by FeLV- and FIV-infected cats that are not showing any clinical signs of disease. Perioperative antibiotic administration may be considered for cats undergoing dental procedures and invasive surgeries.

As stated previously, many FeLV- and FIV-infected cats, particularly those infected with FIV, will live long lives. There is no evidence from controlled studies to show that immunomodulator, alternative, or antiviral medications have any positive beneficial effects on the health or longevity of FeLV- and FIV-infected cats that do not have any clinical signs of disease.

Caring for symptomatic FeLV- and FIV-infected cats
Most of the routine management principles described for asymptomatic cats apply to symptomatic ones. It is essential to remember that illnesses in FeLV- and FIV-infected cats are often secondary diseases acquired because of immunosuppression and not the direct effects of the retrovirus infection. Prompt and accurate identification of secondary illnesses is essential to allow early therapeutic intervention and a successful outcome of treatment. Therefore, more intensive diagnostic testing should proceed earlier in the course of illness for FeLV- and FIV-infected cats than might be recommended for uninfected cats.

Many cats infected with FeLV or FIV respond as well as their uninfected counterparts to appropriate medications and treatment strategies, although a longer or more aggressive course of treatment may be needed. Owners should be forewarned and clinicians should not be discouraged if a response to treatment takes longer than expected.

As in the case of asymptomatic cats, corticosteroids and other immunosuppressive drugs should be administered only to those patients with a clear indication for their use. Griseofulvin has been shown to cause bone marrow suppression in FIV-infected cats and should not be used.15

There is no conclusive evidence from controlled studies to show that immunomodulator or alternative medications have any positive beneficial effects on the health or longevity of symptomatic FeLV- or FIV-infected cats. Antiviral therapy, such as administration of AZT, has been shown to be beneficial in cats with stomatitis and seizure disorders.11 To date, there is no treatment that has been shown to reverse well-established retrovirus infection in cats.
Diseases Associated with Retrovirus Infection

Systemic infections
- Toxoplasmosis
- Aspergillosis
- Cryptococcosis
- Hemobartonellosis
- Feline infectious peritonitis

Gastrointestinal tract disorders
- Lymphoplasmacytic stomatitis
- Necrotic stomatitis
- Chronic parasitism (e.g., coccidiosis, giardiasis, cryptosporidiosis)
- Campylobacteriosis
- Salmonellosis
- Chronic diarrhea

Dermatologic disorders
- Demodicosis
- Notoedric mange infestation
- Fungal infection (e.g., ringworm, other mycoses)
- Unusual bacterial infections (e.g., mycobacteriosis, nocardiosis, actinomycosis)
- Poxvirus infection

Ocular disorders
- Chronic herpesvirus keratitis, conjunctivitis
- Uveitis
- Chorioretinitis

Respiratory tract disorders
- Severe herpesvirus or calicivirus infection
- Bacterial pneumonia
- Pyothorax

Genitourinary disorders
- Bacterial cystitis
- Pyelonephritis
- Renal insufficiency
- Glomerulonephritis
- Incontinence
- Genital chlamydiosis
- Reproductive failure

Neurologic disorders
- Toxoplasmosis
- Cryptococcosis
- Paresis
- Seizure disorders
- Behavior changes

Hematologic disorders
- Myeloproliferative disorders
- Nonregenerative anemia
- Hemolytic anemia
- Thrombocytopenia
- Neutropenia
- Lymphopenia

Neoplasia
- Lymphoma
- Squamous cell carcinoma
- Leukemia

References


Comparison of different in-house tests for rapid diagnosis of feline immunodeficiency and feline leukemia virus infection. *Vet Rec* 2001; in press.


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Editors Note: The guidelines incorporated in this report, produced by the American Association of Feline Practitioners (AAFP) and the Academy of Feline Medicine (AFM) Advisory Panel, were developed on the basis of the best research information, clinical experience, and technical judgements available at the time of preparation. Although the information is intended to be accurate, thorough, and comprehensive, it is subject to change in light of developments in research, technology, and expertise. These guidelines are not exclusive, and other techniques and procedures may be available.

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