Dr. Janeczko: Thank you for joining us. I’m Stephanie Janeczko. I work for the ASPCA as a Senior Director of Community Outreach Shelter Medicine Programs. And I have worked in and with shelters for over ten years now. I actually did a residency in shelter medicine at Cornell. I worked full-time in New York City for a while, and now I do some more national consulting.

I can tell you that every shelter that I have ever worked with, and just about every private practitioner as well, always has questions about FeLV (feline leukemia virus) and FIV (feline immunodeficiency virus). Whether it’s infection, or in particular, about diagnostics, which we’ll spend a fair bit of time talking about today.

What I thought we would do is, we’ll go through FIV, we’ll talk a little bit about the disease itself, how it’s transmitted. We’ll talk a little bit about the testing, because it’s important to understand some basic principles about the disease, so that the testing makes sense.
Then, we’ll do the same for feline leukemia virus, talk a little bit about the disease, how it’s transmitted, some of the information about testing, and then we’ll come back to testing, management, and prevention and control at the end, talking about both together. Because they are two separate viruses, but because of the nature that they’re spread, because of the implications that they have for cats, and in many ways because of the tests that we’ve designed that often pair them together, we usually end up talking about them side to side. So that’s what we’ll do today.

Okay. So, FIV, the feline immunodeficiency virus, gets its acronym from the first letter of the three words making up its name. This is a virus. It’s a retrovirus, which has to do with how it incorporates its genetic material into the cat’s cell. It actually relies on the cat’s DNA to reproduce.

It’s kind of a very tricky virus. It sort of hijacks the body, and then makes the body do the work of creating more viral particles. So this is a retrovirus. The feline leukemia virus is a retrovirus, that’s why sometimes you’ll hear people refer to retroviral testing, or what is that cat’s retroviral status, it’s because of the type of virus that it is.

They’re the same in that sense, but FIV specifically is a lymphotropic, meaning it’s a virus that likes lymphoid tissue. That’s the kind of cells
that it likes. And it’s a lentivirus. And the word “lenti” you may recognize as a Latin root. It means “slow.”

And, that really characterizes FIV, in the sense that this virus causes a very long period of clinical latency. So a very quiet time that goes on for a while that you really don’t know anything is wrong with the cat. During that time, though, we generally see immune function progressively decreasing. We don’t necessarily see that outright, but that’s typically what’s happening.

FIV is very similar to HIV in many ways. There are some real distinct differences, but it’s helpful to think about that analogy, to remember some things about the virus. So they are related morphologically in terms of their shape. They’re also related biochemically. But antigenically, they are distinct.

They’re certainly not transmissible across species. So FIV is not zoonotic even though we do some work with FIV looking at it as a model for HIV, it’s not something that’s that closely related. And FIV in cats, like HIV in people can progress to an AIDS-like symptom, to an acquired immunodeficiency-like symptom. Or syndrome. That does not happen as consistently with FIV as it does with HIV in people, and we’ll talk about that as well.
FIV was actually first reported in 1987. So, not that long ago. Going on 30 years, but you know, in the grand scheme of all things cats, really not that long ago. Increasingly though when we look back, it’s probably been around for longer than that.

It’s a problem world-wide, so this isn’t limited to the United States. We do see it in all domestic cats. How common it is, which is what the word prevalence means, really depends on what group of cats you are looking at. So there’s lots of different studies looking at FIV, and looking at how common it is.

They range in what they report from anywhere to no cats being infected to up to a third of the cats being infected. That will vary with age, it will depend if they tested sick cats or healthy cats, whether they had outdoor access, what they were coming into the vet for, what kind of tests they use, lots of different things. But it’s not an uncommon virus by any stretch of the imagination.

Now, the virus actually has five distinct sub-groups, and they’re just labeled A through E, very simply, that are based on differences in one of their outer envelope genes. So this is a very basic viral structure. So you have the viral genetic material inside, you’ve got some enzymes.
The retroviruses need this funny enzyme called reverse transcriptase that makes the right copy that can get incorporated into the cat’s DNA. And then you’ve got some proteins and lipids on the outside that make up that envelope. It’s that outer portion of the virus that differs. And there’s actually a couple of differences for FIV, so A through E. And we’ll come back to that, because that has some implications for some of our newer testing.

In the U.S., the infections that we see are usually A or B, sometimes C. Clinically, that doesn’t seem to be particularly relevant to us. They can have combinations, they can have recombinants, but it does have implications for testing.

Again, prevalence varies with the population, but when we look at what we think of as being the general prevalence, or how common it is in an average population of cats, usually we settle somewhere on the three to five percent mark.

There was one really large study that tested over 18,000 cats, lots of different settings. Some were tested in vet hospitals, some were tested in shelters, there were feral cats included in that. But a really large study, and it was 2.5 percent of cats overall that tested positive for FIV.
Interestingly, we actually see there being a higher risk of getting a positive result in that one study when you look at cats that were tested at a veterinary clinic, as opposed to animal shelters. That probably has to do with the reasons why those cats were going to the vet clinic and being tested, as opposed to maybe some more routine screening testing that we do in shelters. But the shelter cats did not come up as being a higher risk.

There were a couple of risk factors that we saw that made them more likely to be FIV positive, and these are the ones that I’m sure you think of in your head already. So adults, much more likely than kittens to test positive.

Male cats, especially if they hadn’t been spayed or neutered, that’s sort of our classic poster boy for FIV, right? Big, scarred tomcat, with his big fat cheeks, we worry about FIV.

If the cats were sick at the time of testing, regardless of what their symptoms were, just they got categorized as “sick” or “healthy.” If they were sick, they were more likely to test positive. In particular, if they had abscesses, or if they had stomatitis, which is that really, really severe inflammation of the mouth that we see, and we see that commonly in FIV-positive cats.
We have a pretty good feeling of what we think about risk factors, and how common it is. It’s important to keep in mind, though, that the estimates are fewer than a quarter of cats ever actually get tested for this. So we’re still working off of a limited population, which does restrict what we know about the virus and its disease process.

This is super-tiny, so I apologize, because I’m sure you can all read it perfectly well in the back row. But these are the results from that study. So it was 18,038 cats tested at veterinary clinics and animal shelters in North America. And it breaks it down, I actually have to step over so I can see as well.

It tells you the category, whether they were tested in a shelter or in a veterinary clinic. It breaks it down by geographic region, it breaks it down by source, if they were indoor only, or if they had outdoor access, if they were stray cats, feral cats, or owner-surrenders in a shelter. By their age, by their reproductive status, and then by their health status.

And, so what it shows you is both for FeLV, and for FIV, if you’re interested in looking at that detailed of information, we do see a range. So one percent of cats in the west tested positive for FeLV, compared to almost three percent in the Midwest. And so we see variation depending on what population we’re talking about.
Okay. Transmission. So sometimes you hear FIV referred to as the “unfriendly cat disease,” right? Because this is the one that we think of with the major mode of transmission coming from bite wounds. Deep bite wounds that are inflicted during fighting.

So you know, probably not this tough guy kitten over here, but really when we think about those adult tomcats that we worry about, when they’re out there fighting, they’re inflicting those deep wounds, that’s a real risk factor for FIV. Because that’s a major way, the major way that it is transmitted.

Interestingly, despite its relation to HIV in people, sexual transmission is not a big cause of spread of FIV. We don’t usually see it transmitted in utero, from moms to their kittens, or through nursing. That’s actually helpful to know, and we’ll come back to that when we talk about testing for it in a little bit. But it’s pretty unusual, it does happen, but it’s pretty unusual that mom actually transmits it to her babies.

Horizontal transmission, meaning cat-to-cat, is possible, although it doesn’t occur really commonly. Usually we think of this as being a low-risk if you have a stable household, where the cats are getting along pretty
well, and they’re not fighting, so you take out that bite wounds as a means of transmission.

There have been rare reports that have followed mixed households for years, and they’ve shown that some cats who were not initially FIV positive subsequently became FIV positive. Whether that represents actual transmission through, say salivary contact, not through fighting, or it represents maybe a caregiver who was not attuned to behavior, and maybe missed some of the squabbles, we don’t really know. But we don’t think of that as being a big means of transmission.

With the infection, initially we get very mild symptoms that likely go unnoticed. We see things like a very brief fever, slightly enlarged lymph nodes, maybe a little bit of a decrease in the white blood cell count. Really easy to miss, not something that’s readily apparent.

As soon as two weeks after infection, we can detect levels of virus if we use a PCR test, if we use viral culture. Usually we’re not testing them that early, or we don’t know that we’re testing them that early, but you can actually pick up the virus relatively early in the course of disease.

Then what happens in terms of the clinical outcome for that cat really depends on several factors. So things like age and health status at the time of infection, the dose that the cat got exposed, what the root of inoculation
was. So was it a deep bite wound, or was it maybe more casual contact, just from grooming.

The viral strain will have an impact. Whether or not the cats have other infections going on, whatever type of infection that may be. And then the individual immunologic background.

So, what happens is then the cats sort of go off on two roads. We have infected cats that are positive, and then we have two possible outcomes. And the first outcome is that we have a progressive infection. The virus doesn’t stay in check, the immune system progressively deteriorates as a result of the infection, and we see related diseases from that. And we’ll talk about that.

The other possibility, though, is that the cat remains relatively asymptomatic for a prolonged period of time. I’m sure many of you could tell a story about an FIV-positive cat that you knew who had been positive for years. Twelve, 13, 14, maybe they go on to die of something else that’s maybe related, maybe not related.

It doesn’t have that invariable progression. And we don’t know enough to be able to predict which cats will go which way. But it’s not a guarantee
that they’re going to go down this road of becoming severely immunocompromised.

What it does is, it drops their CD4 t-cell counts. It’s a type of lymphocyte. But despite having low levels of those cells, some of those cats remain healthy for many years. I love this picture. I found it on Google. I put an FIV cat, and he has a t-shirt that says, “FIV won’t stop me.”

[Laughter]

And, it doesn’t necessarily. You know, of the two, we think of FIV certainly a bit different than we think of FeLV. In one study, when they looked at positive cats, 88 percent of the cats at that time were asymptomatic. So they knew that they were positive, but they didn't have any clinical signs.

Again, we do see, or we expect to see progressive dysfunction of the immune system, and it affects the branch of the immune system that works off of the cells, rather than antibodies a bit more. So we see certain types of infections more commonly, less so with other types of infections.

What we do end up seeing with cats who develop disease, typically are chronic inflammatory conditions, certain kinds of cancer, certain kinds of
infections. Infections where the pathogen gets into the cell in particular are the ones that are more common.

For reported clinical signs, there’s a huge range. We see things like weight loss, fever, oral infections. More than a quarter of the cats in one study had stomatitis, so this is that really, really awful inflammation. It can be certainly around the gums and the gingiva. It can affect the arches in the back.

These cats just have big, red, angry mouths. This is the condition that usually what we end up having to do is take out all their teeth to get that inflammation to go away. So that’s definitely associated with FIV. We see it in non-FIV-positive cats as well, though. Dehydration, rhinitis, or nasal inflammation and infections, conjunctivitis. We’ll see uveitis as well, which is inflammation of the inside of the eye.

These cats that all have discoloration, and they actually have some blood on the inside of their eye, that can be a result of FIV. Abscesses we definitely see. And then a lot of other things. Kidney disease, anemia, decreased white cell count, eye inflammation. This is a cat that has a tumor in his chest. So it’s not a short list of what it can cause.
Now with FIV, when they get chronic infections, they actually end up with low levels of the virus circulating around in the blood. So even though we can pick it up initially very early, long term they don’t have a lot of virus hanging around. So that limits our testing options.

What that means, when we do screening tests, is that we’re not actually looking for viral pieces, we are looking at antibodies to the virus. So we’re looking at evidence of the body’s response to that infection. And specifically most of the tests that we use look for antibodies against this little viral antigen that’s called P24.

Now, that’s helpful because these cats generally produce antibodies for the duration of their infection. We associate the presence of antibodies with infection, because we don’t see really carrier cats, or cats that clear an FIV infection, even though they may remain asymptomatic.

The big downside to using antibodies is that the antibodies that a kitten may get from mom, when he or she first nurses, look the same as the antibodies that you get when you give a vaccine. Which look the same for our tests as the antibodies that you get when you have a natural infection.

Any of these three reasons for a cat to have antibodies will result in a positive screening test. When we talk about those little in-house kits that
we use. Even some of the laboratory-based tests that we use. If it’s an antibody test, it can’t tell the difference between these three.

When you get that positive result, you don't know which one of those three that it is. We have some context clues that we can use, and we have some other ways of trying to determine that, which we’ll talk about, but it can’t distinguish the difference. And you can see with maternal antibodies, they can be detected as early as two days, hang around for as long as 12 weeks, even out to 16.

With vaccination we usually think we’ll see them about two weeks after the vaccine. We know they hang around for at least one year, probably much longer. Probably more like four or five. And with natural infection, we can see an antibody response after just a couple of weeks that we expect to persist for life.

How reliable are the results that we get from the FIV tests? There’s two factors that influence how reliable any test is. So this is regardless of whether we’re talking about FIV or FeLV, or what kind of test kit we’re using. There’s sort of two big parameters.

The first is how common is the condition? How frequently do we see it? What’s the prevalence? That’s going to have an impact on which results
we’re more likely to believe. The second piece of this is the test that we’re using itself. What’s its’ sensitivity, and what’s its’ specificity?

Those are two measures that talk about how good the test is at doing the job that we want it to do. Namely, how good is the test at identifying all of the infected animals, so we don’t miss some of them and call them negative. We actually get all of the infected animals.

Also, how good is that test at only picking out the animals that are infected with what we’re testing for? So they’re not lumping in lots of other stuff because they get confused. So those two things will influence any test in terms of how reliable it is.

When we look specifically at FIV, and those screening tests, which is the ones that we use most frequently, those tests are highly sensitive, and they’re highly specific. So very infrequently do they misidentify a cat as being positive when they’re not actually positive. And pretty infrequently do they misidentify a cat as being negative, if he actually has those antibodies hanging around. They are actually very good tests.

Usually when we’re doing this test, especially if we think in a shelter setting, if you’re testing every cat when they come into you, if you’re
testing every cat before they go up for adoption, we don’t expect that to be super-common in that population of cats.

Probably somewhere in the three to five percent range. So maybe ever three or five out of 100 cats you’re going to get a positive result. And so what that means is, our negative results we don’t expect to find the disease very often. We can be more confident in our negative results than we can be in our positive results.

Here are your options with FIV testing. And again, I’m talking about that screening test that looks for the antibodies. Option one is you get a negative result. And that can mean a couple of things. It can mean the cat doesn’t have FIV, it could mean it’s a very recent infection that the cat hasn’t had enough time to mount an immune response. So maybe he just got infected last week, and he doesn’t have enough antibodies in his bloodstream that he’s going to show up positive on the test.

Very infrequently, with very late-stage infected cats who have FIV, as their immune system becomes so dysfunctional they’re not able to keep producing antibodies, so occasionally we will see negative results in very, very sick FIV-positive cats. Or if you got an inaccurate test result, you can get a negative one. Maybe you didn't follow the manufacturer’s instructions properly or you didn't do something right there.
In terms of positive test results, here are your options. The cat’s infected with FIV. Another option is the cat has maternal antibodies, which is only true if it’s a young kitten. They do go away after a period of time, so if it’s an adult cat, you can take that one off the table.

It could be that they’re vaccinated. It could be that they’re infected and they’re vaccinated. Because again, you can have both of those there. The vaccine isn’t perfect. Or you could have an inaccurate test result. So it’s not quite as simple as just saying yes we have a negative, or we have a positive. Because sometimes it doesn’t mean exactly what we think it does.

For the negative result, we generally consider those to be highly reliable, especially if you’re testing just generally healthy cats as a screening technique. The positive results we look at with a little bit more of a careful eye.

Especially if you have an asymptomatic cat, you have a cat who really doesn’t seem like he should be very high-risk, or she doesn’t seem like she should be high-risk. Those are the results that we question. And when we can, we want to try to confirm them.
When we’re able to, we like to not rely on a single test, because no test is perfect. These are very good tests for FIV. The ones that we use for FeLV are very good tests as well, but they’re still not perfect. And so ideally we want to confirm all of the results that we get.

If you get a negative result and you don’t know every last thing about that cat, which is pretty much every cat that we all work with, you really want to retest that cat in 60 days. So that you can be sure that that negative result is really a negative. And you’re not just missing an early infection.

That doesn’t necessarily mean you have to redo the test. Maybe that cat isn’t with you any longer, but you’re giving that information to the adopter, so that they can speak with their veterinarian, and they can make a decision to go on and retest that cat.

If you have a positive result, ideally we want to retest those cats as well. We can either do that now, or we can do that later, and it depends a little bit on what you’re trying to accomplish. Now in reality, this is not always possible, and we’ll talk about what happens when that’s not possible in making a decision.

The reality is for many shelters, they don’t have the resources to hold and do all that confirmatory testing and to repeat. And we’ll talk about what
some of those challenges are. And you can make decisions if you need to, off of a single result. Recognizing that it’s not ideal, and also recognizing that sometimes the decision that you think you’re making with accurate information, it’s actually not a true result. So when we can retest, we like to.

The confirmatory testing for FIV, again, this is if we’re trying to confirm positive results, especially if you have a low-risk cat, you have an asymptomatic cat, because we worry that maybe that test result’s incorrect, you have a couple of options. The first option is go ahead and do another one of those in-house antibody tests.

Preferably one that’s made by a different manufacturer. So if you use the Idexx test normally, and you keep a couple of the Symbiotics test on the side, you can pull out one of those and use one from a different manufacturer.

You can send a sample out to the lab to do something called a Western blot. And it ends up giving a result like this. Thankfully you don’t get this back from the lab and have to figure out what it means.
You just get a positive or a negative result. So the lab takes care of worrying about that. But basically you’re running out pieces of DNA on this gel, and then they correspond that with some known markers.

Interestingly, Western blot is the one historically that we’ve always said do as the confirmatory test. You get a positive test on the kit that you’re using, go ahead and send it out for the Western blot.

That is still usually the path that we follow, although we now know that the Western blot isn’t quite as good as we thought it would be. And in some settings, the in-house tests actually seem like they perform better. So that’s unfortunately a little bit of a downside.

PCR testing has become relatively recently available for FIV. And one of the nice benefits of PCR testing in theory, is that you should be able to use it to distinguish antibodies that are there from vaccination, or antibodies that are there from natural infection. Because the in-house test can’t make that distinction, the Western blot can’t make that distinction, but hopefully the PCR can.

So, it sounds like a good thing. Unfortunately, the PCRs that are available right now are pretty variable in performance. They’re different from different labs, in terms of what they use for the primers, or the little
section that they use to kind of jump start the replication of the virus that
they’re trying to detect.

Some of them are very sensitive, some of them are less so. What we
usually say about the PCR is, if you get a negative result, it does not rule
out infection. So if you get a positive result, that can be helpful. If you
get a negative result, that is less helpful. And one of the big reasons that
this is so kind of, “Meh,” in terms of how it works, is remember I told you
FIV has A, B, C, D, and E subtypes?

They’re all a little bit different. And you can potentially have a PCR that
maybe only picks up a couple of them, they have a different subtype, they
have a combination of it, or multiple subtypes. So unfortunately still
we’re not really relying tremendously on this. Alright. So we’re going
to move on to FeLV, and then we’ll come back at the end and talk about
testing together. Did you have a question?

Audience member: Just curious. You were saying that it’s usually not passed on through the
mother. What if both parents were positive?

Dr. Janeczko: Yeah, so it’s not frequently transmitted sexually. It is--now the virus is
present in saliva, it’s present in blood, it’s present in semen, it’s present in
low levels in milk. So there is a theoretical risk. But for whatever reason in the natural setting, it is really uncommon.

So, our default assumption when we find positive kittens is that you must have maternal antibodies. Now, it’s not a guarantee, so we can’t just write those off in young kittens and assume that’s where they came from, because the transmission does occasionally happen. But it’s really not something that happens very frequently.

Okay. So, the leukemia virus is also a retrovirus. It’s in a different family now. This is one that’s in oncornaviridae. That’s just the family that it’s in. And interestingly, I actually think this is a very interesting virus. So it was first isolated from a cat with lymphoma. That was how they originally found it. They then went on and showed that that tissue could infect other cats, and they ultimately realized what virus it was.

It’s a really interesting virus in the sense that it can infect many tissues, and it causes a really, really broad range of clinical signs. The outcome of infection for each cat, though, can be very different. And that’s going to depend on the cat’s immune status, on their age when they get exposed.
It’ll depend on the pathogenicity of the virus, what the infection pressures are, what the virus concentration is. So lots of factors. So it’s not just cat plus virus equals infected cat. We have lots of variability going on there.

This one was first identified in the ‘60s, actually. And thankfully since we’ve identified that, we’ve done a lot to decrease the prevalence of the virus in the cat population worldwide.

A lot of that is because of test and removal programs that started in breeding facilities. And then just general screening and knowledge of pet cats and in shelters, so that we can limit disease transmission and reduce the number of cats that are infected. We also have a vaccine available for it now, so that does help reduce transmission as well.

The prevalence, like FIV, varies a bit, depending on what geographic area you’re talking about, how the cats were tested, whether or not they were sick. Usually in studies we see less than two percent in healthy cats, but we can see over 15 percent in high-risk or sick cats. So a lot of variability, depending on who you’re looking at.

We see similar risk factors for FeLV infection as we do for FIV infection. Males more than females, adults more than kittens, sick cats, those with outdoor access, those who are not spayed and neutered. So very similar
kind of things that make us worry about a cat testing positive for FeLV, as we worry about with FIV.

This is that same very difficult, I apologize, to read slide that shows you all of the different breakdowns for FeLV and FIV. And again, it varies depending on what group of cats we’re looking at.

Transmission. So we said FIV you can think of as the “unfriendly cat disease,” FeLV we sometimes call the “friendly cat disease.” Because we have transmission through a couple of major ways. One is from queens to their kittens. So unfortunately, this is something that is commonly passed.

The other one is cats who have close prolonged physical contact. So the cats who are loving on each other. Who are living together, and they’re grooming each other, they’re sharing food and water bowls. Because the virus is spread in the saliva. And so when you have that close, ongoing contact, that’s a risk for transmission.

It can be spread through bite wounds as well. And we do think of kittens as being more susceptible to getting infected than we think of adult cats being. You can very much infect an adult cat with FeLV, that’s not to say that you can’t. But all things being equal, we do tend to see a higher risk for the kittens getting exposed than we do for the adults.
With an acute infection, when they first get exposed, the virus replicates in those lymphoid tissues again. And you get pretty mild signs that can be really easy to miss. A little bit of fever, a little bit of lethargy, some diarrhea. Maybe not something that you really realize anything is going on.

Their white blood cell count may drop a little, their lymph nodes may be a little big, but not necessarily glaring, that anybody’s going to realize it. And within just a week, we can find the genetic material from the virus if we look with PCR. So it again happens very quickly.

Now, we sort of have branches for FeLV, again, following infection, or following exposure. And there’s two big categories. FeLV is a really complicated disease. There’s lots of weird clinical syndromes it causes.

There’s a couple of different outcomes with infection that we don’t understand really well, and that honestly are not very common, so I’m really not going to spend time talking about them, because for the context of what we worry about, they just don’t come up that much.

But, we have two big categories for what happens with most cats after they get exposed to the feline leukemia virus. So they get exposed, the
virus is in their body, it starts replicating, and then one of two things happens.

The first is that they develop what we call a progressive infection. And that’s where the virus keeps replicating, they have viral particles in their bloodstream, they have the antigen in their bloodstream, it eventually incorporates into the bone marrow. Those cats will continually test positive. Those cats ultimately usually become ill.

The other fork in the road is that they develop what’s called a regressive infection. Or some people call these transient infections, which you may have heard. So the cat actually mounts an adequate immune response, and does not have that virus integrate itself or make its way to the bone marrow. And those cats usually will then go on to test negative, and not develop disease associated with the virus.

So, we have two branches down the road. Now, once we get to the point that they have that progressive infection, unlike FIV, we do tend to see that continual march towards sicker cats. We don’t have a lot of cats who stay asymptomatic for a long time.

Those progressive infections, you get a lot of virus replicating in the tissues. It gets to the bone marrow. Ultimately it spreads to the salivary
glands, which is why the virus becomes incorporated in the saliva, and that can serve in transmission.

Most of these cats will stay persistently antigenemic. Meaning they will continue to have virus antigen in their bloodstream that you can test for with those in-house screening tests. Unfortunately these cats often succumb to FeLV associated disease within a few years.

The younger they’re infected, if they have outdoor access, if they live in multi-cat households, we tend to see those cats deteriorate more quickly. But within a few years, they often do succumb to that disease.

The regressive infections are what we hope for, if the cat’s going to get exposed. And that’s where they get enough of an immune response that can limit the virus replication. And it doesn’t incorporate itself to the bone marrow.

You’ll be able to find the antigen in these cats for a couple of weeks. Maybe two to three weeks if you happen to catch them in that window, they’ll test positive. And then it goes away. Usually two to eight weeks later. So they get that transient period of time that they have a viremia, or that they have the virus in their bloodstream.
What this means clinically, we don’t know 100 percent. Unfortunately we don’t understand this really well. The thought though, is that if they develop these regressive infections, they’re unlikely to go on to develop disease, and they are unlikely to pose a significant risk of transmission to other cats.

Weird ways, like a blood transfusion or something like that, because we do think they still have some of the viral DNA floating around, may happen. But sort of for your average cat, and what we worry about with transmission, we think these guys probably aren’t much of a risk.

Then, the other two, just if you’ve ever heard them, they are associated with FeLV. There’s something called an abortive infection, where they basically do end up clearing the virus. We think that happens very rarely, if at all in cats. Or something else that’s very unusual that’s called a focal infection. And that is where they have virus limited to one or more areas of the body. So maybe you can just find it in the spleen, or you can just find it in the bone marrow. Really, really uncommon. Not ones that we really worry about with most cats.

That I put in there just for reference. It’s a little table that I know you can’t read, but it sort of tells you where they fall in terms of having virus
in their bloodstream, or whether or not they’ll test positive on the different
test kits. But we’re going to talk about that.

Unfortunately with FeLV, we do see that progression to clinical disease
and death much more consistently than we see with FIV. FeLV in
particular can cause really nasty anemias. It can cause all sorts of
abnormalities in the bone marrow, in terms of bone marrow suppression,
an inability to generate those white blood cells, or even the red blood cells
that the cats need to live.

It is associated with causing lymphoma, that specific type of cancer in
cats. It’s not the only cause of lymphoma. Cats can get lymphoma
without having this infection, but it is known to be a cause. And then lots
of other infections.

So, lots of secondary bacterial infections, or other infections that maybe
wouldn't necessarily cause severe clinical signs in a healthy cat, we’ll see
much more in FeLV infected cats. So the hemoplasmas, which are red
blood cell parasites, cats who have a corona virus.

When we look at cats who are positive for FeLV, we said when we looked
at those cats that are positive for FIV, almost 90 percent of them were
asymptomatic. So when they looked at similar groups of cats with FeLV,
it was less than a third of them that were asymptomatic. So we see those
diseases, or the FeLV associated diseases much more commonly.

A lot of similar, vague symptoms. Weight loss, fever, dehydration. We
see the rhinitis again. We’ll see diarrhea, we’ll see conjunctivitis.
Inflammation, abscesses. So lots of really non-specific things. A lot of
overlap with FIV, lot of overlap with many other illnesses in cats.

Unfortunately, how long they survive in this study, so if you looked at
how long the cats survived from when they started checking them out, the
cats who had FeLV lived half as long as the cats who did not. So it really
does have a significant impact on their longevity, and on their health.

Alright. For testing for FeLV, now we sort of go the other way. So for
FIV, we test looking for antibodies. For FeLV, we test looking for pieces
of the virus. The virus gets its genetic material incorporated into the cat’s
DNA, and then that gets copied when the cells reproduce.

The virus makes several different proteins. If you think back to that first
picture, and it’s kind of that ball, with all the little spiky things coming off
of it. So it’s some of those outer spiky things that are coded by the genetic
material, some of the internal structural proteins.
But, there’s one called P27 that the virus produces, that we find in high levels in infected cats. And so that’s what the test looks for. It’s actually looking specifically for little pieces of the virus. And this little piece of the virus in particular.

We’re checking for this in the bloodstream. Usually we test looking in the blood. That’s the most common way we do the screening test. There are salivary tests. Most people don’t use those anymore because they’re not nearly as reliable.

When we talk about looking for it in the bloodstream, it’s important to remember that what this test tells you is yes or no, there are viral particles in the bloodstream. It doesn’t tell you anything about whether or not the virus has made it to the bone marrow, and sort of set up shop as that permanent infection. This test can’t tell you that.

This test cannot distinguish between those progressive or regressive infections. If you accidentally get the timing right, you may catch a cat who’s going to not stay antigenemic or viremic. They will not continue to have this circulating in the bloodstream. And if you retest them later, they’ll come up negative. But you don't know off of the basis of one single test result.
So, same factors influence FeLV testing reliability as they influence FIV testing reliability. How common it is, and the sensitivity and the specificity of the test that we’re using. So the good news again, is these are highly-sensitive, highly-specific tests. They’re really good at looking for what they’re supposed to be, and only finding that.

And, usually we’re looking in a population that has a low prevalence, where this is not very common. So we expect our negative results to be pretty reliable. It’s our positive results that we worry about a little bit more, if you’re just talking about your average, outwardly healthy cat. Here’s what you have by way of options for positive and negative results. You get a negative result, it could mean the cat’s non-infected with the leukemia virus. It could mean it’s a recent infection, that they just don’t have enough virus in their bloodstream for you to pick up yet. It could mean it’s one of those weird focal infections, which probably isn’t anything that you’re going to see. Or it could be an inaccurate test result.

If you get a positive result, it could mean the cat’s infected with FeLV, and it has one of those progressive infections that we think will go on to cause disease. It could be that the cat has FeLV, but they’re going to become a cat with a regressive infection that isn’t going to make them sick.
Very, very, very recent vaccination, in theory, can cause this to be positive. Like, if you give a vaccine and then you draw blood an hour later to test the cat, because it’s looking for a piece of the virus, you may risk getting a positive result. Now, we always test before we vaccinate if you are going to vaccinate, so that really shouldn’t come up as an issue. But if you reverse the order, it’s theoretically possible.

Then, of course, you could have inaccurate test results again. So for that average, healthy cat, we’re more trusting of our negative results, and we’re more likely to question our positive results, just because of the way the test works, and in terms of how common it is.

Again, no test is perfect. We really like to confirm the results when we can. If you have a negative result, you want to repeat the test at least 30 days later to make sure it’s still negative, and not from a recent infection.

Now functionally, we usually just wait and do it 60 days later with FIV, so that you’re not breaking up the tests and making a lot of work for yourself. And that’s fine. 30 days is the minimum. Usually we just do them together.

If you have positive results, then we’re looking at additional testing. Either now or down the line, usually we start doing it right away. And
again, recognizing that this isn’t always possible, we’ll talk about what the confirmatory testing is, if you can do it.

The ones that we want to worry about, those positive results, if it just doesn’t seem like that’s a cat we’d expect to test positive. And the second test that we usually run for FeLV is called an IFA. And it’s a test that looks, it’s actually a really cool fluorescence test. You have to send it out to a lab, because they need to have all these fancy microscopes for it. But, what it looks for is pieces of the virus that have now been incorporated into the bone marrow. And this is the test that can tell you, okay, I have to worry that this cat has a progressive infection, because now the virus is in the bone marrow.

If you get a negative result, it means it’s not in the bone marrow. Whether that’s because it’s never going to get there, or you just tested too soon and it hasn’t made it there. Occasionally if they really have had their bone marrow wiped out by the virus, you’ll get a negative test as well. But usually it just means that it hasn’t gotten there either yet or at all.

If you have a positive result, it means that you have antigen in the bone marrow. And we really take that, once we can pick it up in the bone marrow, we take that to sort of be crossing the gate into cats who are going to have that progressive infection. We don’t expect them to sort of
be able to turn around and not get sick once it’s been incorporated into the bone marrow.

There is also PCR testing available for FeLV. It’s not used nearly as commonly as we use those in-house tests of the IFA, but it is available.

Discordant results. If you do confirmatory testing, if you do follow-up testing, this is what you are praying does not happen. Because this is a huge headache when it comes up. What discordant results mean is that you are getting two results that don’t match. And usually when we’re talking about this, we’re talking about that ELISA, which is your in-house test, and then you send it out for an IFA, and you get two different results. So you don’t get two positives, or you don’t get two negatives. You get one positive and one negative.

Usually what you’re getting is a positive in-house test, and a negative IFA. Because usually we don’t send out an IFA on those negative results. So cat tests positive, you think, okay, maybe it’s a cat who’s going to not go on to develop FeLV, we want to confirm it, we send out the IFA. And now the IFA comes back negative.

Now you’re really kind of stuck. This is when swearing usually starts, if you’re a person who swears. Or throwing things, or something like that.
Because there’s a bunch of different reasons you can get that result. It could be because of the stage of infection. It could be variation in the cat’s response, or sometimes it’s technical issues, in terms of how the test were run.

What do you do when you get those mismatched results? Well, the safest thing to do, in terms of the risk to other cats, is to assume that this cat, assume the worst-case scenario, that this cat is a source of infection, and you need to keep them isolated from other cats accordingly. Because you don't know.

We repeat the testing. Usually we repeat both in 60 days, and then if they still don’t match, we start doing it yearly. Until the results eventually come in line and agree. And in some cats, that goes on for years before the results come in line and agree. The unfortunate reality is you can’t say which one is correct.

Even though we want to be able to pick which one is correct, if you have a positive in-house test and a negative IFA, you can’t say which one of those is right. You may have tested that cat too early, before it got to the bone marrow, and when you retest down the line, your IFA will come up positive, and that cat really is infected, really will go on to develop a progressive infection.
You may have caught that cat before it got to the bone marrow, and he’s going to clear it. And if you go and you retest them, both tests will come up negative. And then some of the cats, again, they have those discrepant results, or those discordant results for literally years.

This is a huge challenge in a shelter setting. Because what your options are, to even pay to do the confirmatory testing, may be constricted. Then, the concern comes up, what happens when the results come back and they’re discordant? Is it realistic to hold that cat, for that cat’s welfare? For the other cats in the shelter, knowing that you may end up holding them for years down the line?

Now certainly that is not the most common situation. But these come up frequently enough that they are a big headache. And unfortunately there’s no way to know which one is right. We just have to keep retesting.

In terms of management, I’m not going to spend a lot of time talking about management or treatment, because it’s really not something that we generally deal with on a day-to-day basis. I wanted to really focus on testing.
But, there are several recommendations. Some of these have direct implications in the shelter. Others are recommendations for adopters, if you have positive cats that you’re adopting out.

Usually we say that they should be kept indoors. That’s to reduce the risk of transmission to other cats. That’s also to try to protect that cat from being exposed to other infectious diseases that they are more likely to become ill from, because the viruses can cause immunosuppression. Certainly, we want to reduce stress on them. We want to make sure that they have an appropriate diet, that they have good husbandry. These would not be cats that feeding something like a raw diet to would be a really good idea, because we worry about them getting infections.

Having them spayed or neutered if they are not already, that helps to reduce the stress that’s associated with cycling and seeking mates. Having a good program for parasite prevention and treatment. There are certain drugs that we know we’re going to avoid.

Steroids, for example, which can further suppress the immune system, we really try not to use in these cats unless we don’t have another option. Other drugs, griseofulvin is an old drug that used to be used to treat ringworm. We don’t really use it very much anymore, but we know that
can knock out the bone marrow in these cats, so we really try to avoid it in them.

And, then regular veterinary exams. Usually we say at least every six months. And that’s so that we have early detection, and that we can identify common problems that come up early. These are cats that we tend to jump to doing some more diagnostic testing a little bit earlier than we would in an otherwise healthy cat. Just because of that risk for secondary infections.

Usually yearly we’ll recommend doing blood work, checking the urine, checking a fecal. Again, just really trying to stay on top of anything that could make them ill.

In terms of treatment, unfortunately we do not have much in the way that’s available. Antiviral therapy, or immunomodulating therapy are the two sort of question marks. The idea with both is that you reduce the viral burden, which should alleviate the clinical signs.

The reality is, we have limited drugs that are available. They’re not really well-studied, in terms of what the options are. So these are drugs like AZT, actually, in terms of antiviral therapy. Really not something that’s used very frequently.
Immunomodulating therapy a little bit more. This would be interferon, for example, whether you’re using feline or human interferon. Again, we don’t really know. There’s been some data that maybe it helps, but the reality is, we don’t have a great treatment modality for either of these conditions.

Vaccinations, routine vaccination with the FVRCP, for example, is a little controversial, but generally recommended, again just to reduce the risk of other infections. We do know that at least FIV-positive cats can adequately respond to vaccinations.

There’s some concern that maybe you also stimulate the immune system, and then you have more virus that’s produced. We don’t really know what the implication of that is, and so in general, we try to make individual decisions based on their exposure. Whether or not to use a killed or a modified live product, which vaccines to use, it’s very much on a cat-by-cat basis.

The good news for shelters is that this is really not a concern in terms of outbreak for shelters. This is not something that we worry about in the same way that we worry about panleuk, or that we worry about URI, because of the means of transmission.
Direct contact obviously still remains a concern. And it is very efficiently transmitted by bodily fluids. So whether that’s cat-to-cat, or if we’re doing something inappropriate, like using the same surgical pack for multiple animals, or even multiple litter mates. Not changing needles. Contaminating multi-dose vials of drugs. All of those things, that can be absolutely a risk of infection.

In terms of housing, if you’re housing cats individually, we don’t really worry about transmission here. And so testing is considered optional if that’s the housing for your cats. But if you co-house cats, or you group house cats, you really want to know their status before you put them together.

Whether you’re taking orphaned kittens, and you’re putting them onto a surrogate queen, or you have a room that has six adult cats in it, you really want to know before you put them in, because you don’t want to transmit disease.

These cats we don’t want to house in isolation, if you do have positive cats that you’re keeping in your facility, you don’t want to house them in isolation with all the cats who are contagious. They’re already at greater risk of contagious disease, so you just want to make sure that you have them in a protected area.
In terms of cleaning and disinfection, the good news is that these are relatively wussy viruses. They don’t hang around for super, super long. Certainly within a week or so, we really don’t worry about them. And that’s at the outside. If you have like dry cat spit with snot in it, and it dries, theoretically it could be a risk for about a week. But regular, routine sanitation procedures that you have, pretty much all of the disinfectants are going to work.

There are vaccines, both for FeLV and for FIV. There’s a couple of different FeLV vaccines that are available. It’s considered non-core, meaning it’s not recommended for every cat. It’s really just for cats who are at risk of exposure.

And so what that means for shelters is, we may consider it if you have group housing arrangements. So you test, and then you vaccinate before you co-house with other cats. If you’re doing individual housing, again, there’s not much of a risk of disease transmission, so we really don’t look at doing the vaccination.

There is a general current recommendation that you may hear. This is not shelter-specific, but a general recommendation that maybe all kittens should be vaccinated, because of their greater risk of developing an
infection, change in maybe ownership, lifestyle, all of those different things. So you do hear that sometimes. In practice we don’t often do that in shelters, though.

The vaccine’s not perfect, though. It doesn’t provide absolute protection, and it’s not a substitute for appropriate management, in terms of trying to limit contact with infected cats. You always want to test before a vaccination. And the good news is this one doesn’t impact results. So if you test a cat, or if you vaccinate a cat for FeLV, and you go on to test them, it’s not going to interfere the way FIV does.

FIV, there is also a vaccine for. We limit this to high-risk cats. It doesn’t provide complete protection either, so it doesn’t have all of the different subgroups. They can still get infected if they’re vaccinated. Again, we always test first, because it doesn’t do any good to vaccinate an infected cat.

But this one is hard, because this, remember the picture of all the antibodies looking the same, this impacts your test results. And it will hinder your ability to just use one of those screening results in the future. So we want to really try to identify these cats as vaccinated.
Certainly these cats are typically neutered. Ideally if you have them microchipped, you can include that information in their microchip registration so that we know their status, so that it doesn’t become a question down the line.

I just want to wrap up with a couple of brief points. For those of you who aren’t aware, there are guidelines for testing and management of FeLV/FIV that are put out by the American Association of Feline Practitioners.

Their website is catvets.org, and if you go to their website, you can download this for free. So they have a really long version, and then they have a very pretty, mini version. So they’re not specific for shelters, but they have a lot of really handy information in there.

The Association of Shelter Veterinarians also has a position statement on testing. And I wanted to end on this one. Whether or not FeLV/FIV testing should be done in shelters. And the statement, the most relevant piece of it, is that it should remain the decision of each individual shelter to determine if and when retroviral screening should occur for cats in their care.
Testing before adoption is ideal, and is strongly recommended. Policy should be based on available resources, though, so that may not be feasible for every organization. It’s also going to depend on the potential impact to the population, and the program goals.

So, a couple of quick questions that I’ll finish with. At what age should we test? This one comes up a lot. Our goal is to get all cats and kittens tested before going to their new home, if not sooner. And so the good news is that the results are valid in young kittens, we just have to be careful about how we interpret them.

If you get positive FIV test results in a young kitten, we worry about it being maternal antibodies. We want to hold those kittens and retest them as they get older. Usually they will test negative, and then we can be comfortable.

Some people say, well why bother testing them when they’re this young, if you’re not going to be able to rely on the results? And the reason why is, when you have negative results, you can be very confident--we want to retest those kittens to be sure, but you can be really confident that that kitten’s probably going to be negative. And then you can go and you can get him adopted out. So when he’s eight weeks, and he’s still fluffy and
cute, and everybody’s lining up to take him, instead of having to make an arrangement to hold him until he’s maybe four to six months.

You want to make sure that you follow all of the manufacturer’s recommendations, and you need an individual test for an individual cat. You can’t do eenie, meenie, miny, moe, and say, well I’m going to test this kitten, and say that he’s representative of everybody else. Because you can have variation in the litter.

You also can’t take blood samples from multiple cats or kittens, take one drop from each and mix them together. You can dilute it out and end up getting incorrect results. And you really shouldn’t rely on testing the queen and not the kittens as well, because again, the status isn’t going to always match.

When you test is going to depend on your facility. It’s going to depend on your resources and the population that you’re caring for. So ideally you’re going to test all cats. If you group house, you really need to test them before they come into contact with other cats.

If you have limited resources, you’re going to try to stick to certain cats. So maybe those cats that are in adoption, high-risk cases, the tomcat who comes in with an abscess, or that really anemic, unthrifty kitten.
Certainly before you were going to go on and invest additional resources in them, in terms of like emergency car or anything like that, this would be a really good time point to test them.

You need to use individual housing until their status is known. And if you have positive results, or if they’re unknown, you want to assume that they’re positive, and keep them separate. And if you’re able to do that on the negatives for 60 days, that would be idea. In reality, we rarely do that. Just make sure that you record the results. Some of those are going to influence care while you’re at the shelter. It’s certainly information that if you are testing prior to adoption, that you really want to share with the adopters or the owners if they’re going back to an owner.

Then you need to assume that they’re infected until they’re proven otherwise. So again, you really, if you’re able to, want to test everybody, or at least be very selective, and test the highest-risk cases. If you keep cats long-term, you really want to retest them annually, just to make sure that you didn't misrepresent somebody’s status.

If you do TNR, we usually say don’t test. And the reason why is, because you will do much more to reduce transmission of FeLV by spaying and reducing the transmission to the kittens, and you’ll do much more to
reduce the transmission of FIV by neutering and stopping that fighting than you will be by testing positive cats and then taking them out and euthanizing them.

Yes?

_Audience member:_ Just a question on testing for [inaudible] asymptomatic versus symptomatic?

_Dr. Janeczko:_ So, and that’s a really great point, Jesse. Thank you for bringing that up. Usually when we talk about not testing in a TNR setting, we’re talking about not doing that general screening testing for all of the cats. Certainly if you have a cat that you’re worried about because of their clinical signs, because they’re not doing well, because they seem very high-risk, absolutely we want to test those cats, and then make a decision. But in terms of just general screening.

These are two really nice algorithms that you can download online. They sort of walk you through, do this test, if you get a positive result, do this test. If you get a positive result, do this test. And so I realize that you can’t read them on here, but they’re just a visual representation of what we talked about, so I put them in here so they will be on the presentation.
The first one was for FIV, it’s broken up for adults and kittens. And the second one is for FeLV. And I’m going to stop there.

[Applause]

Thank you.

[End of Audio]