



# NATIONAL VETERINARY LABORATORY

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## NEWSLETTER

### As Expected, It has Happened!

### A Spillback from a Domestic Pet Cat to a Veterinarian!©

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#### In This Issue:

The Summer 2022 NVL Newsletter will stress, as we have feared, a SARS-CoV-2 **spillback** from a pet cat to a person, a veterinarian! We will discuss animal reservoirs of SARS-CoV-2 and the dangers these present and the unfulfilled One Health Approach to responding to pandemics. This pandemic is **still not over** and we may have to live with it for the foreseeable future.

#### Definitions:

##### Spillover:

**CDC definition:** Spillover is a single event during which a pathogen from one species moves into another species; such movement can result in an outbreak.<sup>1,2,3</sup>

**Wikipedia definition:** Spillover is the zoonotic transmission of a pathogen from a vertebrate animal to a human. It is a common event, in fact more than two-thirds of human viruses are zoonotic.<sup>1,2,3</sup> Spillovers can result in different chains of infections in people:<sup>2</sup>

##### Chains of Infection:

1. Some spillover events are **dead-ends** where there is no further human to human transmission. Examples are rabies, anthrax, or histoplasmosis.

2. In other spillover events, the zoonotic pathogens are able to be transmitted by humans to produce secondary cases and are even able to establish **limited chains of transmission** in people. Examples are the Ebola and Marburg filoviruses, the MERS and SARS coronaviruses and some avian flu viruses.

3. Finally, a few spillover events can result in the serious final adaptation of the microbe to humans, who become a new **stable exclusive reservoir**, as occurred with HIV resulting in the AIDS epidemic. Most of the pathogens which are presently exclusive in humans were probably transmitted by animals sometime in the past.<sup>2</sup>

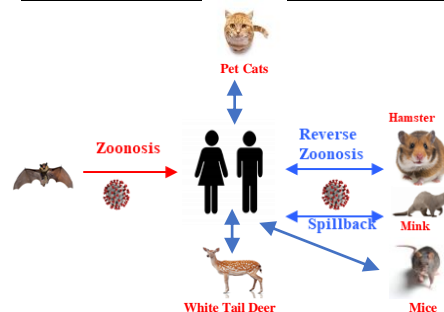
4. The present SARS-CoV-2 COVID-19 pandemic seems to be evolving, with the generation of numerous mutants, into an **unstable human-adapted pathogen**. This is due to various spillovers (reverse zoonoses) into different animal species and now **spillbacks** occurring from these species into humans.

#### Spillback:

‘Spillover’ is commonly used to describe pathogen transmission from non-human animals to humans, ‘**spillback**’ is used to describe pathogen transmission from humans to animals. However, the SARS-CoV-2 pandemic has led to increased concern over transmission of pathogens from humans to animals and the term (“**spillback**”) is often used. Since we are considering this current pandemic, we choose to use the term “**spillback**” to mean an animal transmission of their human derived SARS-CoV-2 virus from an infected animal species back into humans. **Spillback** is of great concern because newly infected animal species may act as an additional reservoir of the virus or, even worse, may act to generate mutant strains, variants, which will be more transmissible and more deadly.<sup>4,9</sup> The following examples highlights this phenomenon.

#### SARS-CoV-2 Animal Spillbacks

Animal	Spillbacks
Mink	Yes
Hamsters	Yes
White Tail Deer	Yes
Mice	Yes
Pet Cats	Yes
Next????	???



#### Animals- Spillbacks:

**Susceptibility:** Many animal species are susceptible to infection of SARS-CoV-2 from people (covered in our Newsletter “Animals and the COVID-19 Pandemic” Winter 2022, Vol. 21, No.1) and some can transmit the virus directly among their species. Five animals, mink, mouse, deer, hamster, and now pet cats are able to re-transmit the virus back to people (**spillback**).<sup>5-9</sup>

**Mink:** Millions of minks have been infected from humans with SARS-CoV-2 and minks, in many worldwide mink farms, have been eliminated due to the **spillback** to humans.<sup>5</sup>



Mink-Spillback

**Hamster:** Occurrences of **spillbacks** from pet hamsters to their owners have been reported.<sup>6</sup> Pets are a major concern as they live closely with people. There have been no reports of **spillbacks** from pet dogs but another pet, cats, can be infected from their owners and can transmit the virus to other cats by the aerosol route. Now there is the first report of **spillback** from a pet cat to a veterinarian.<sup>10</sup>



#### Mouse: Origin of Omicron Variant- Mouse-Spillback<sup>7</sup>

The Omicron SARS-CoV-2 mutant was first found in South Africa on November 24, 2021. It spread rapidly throughout the world and is now dominant. It is much more transmissible than the original Wuhan isolate. There is evidence that an earlier mutation, transferred from humans to mice sometime during 2020, mutated quietly as it spread among mice for over a year, before **spillback** to humans late in 2021 occurred.<sup>7</sup> The authors did an elegant genetic study of the generation of numerous mutations in the S-protein of Omicron SARS-CoV-2 variants. The mutations occur in a pattern unique for each species of infected animal. They found the Omicron variants in people matched the pattern specifically from mice.<sup>15</sup>



**Deer:** Many white-tailed deer, in the USA and Canada, have high prevalences of SARS-CoV-2 infections with several variants. A group found divergent lineage of SARS-



CoV-2 in the deer with mutation signatures of host adaptation under neutral selection. There is an epidemiological link to a human case in the area which indicates **spillback**, deer-to-human transmission.<sup>8,9</sup> This is new evidence that mutants are being generated in deer which might make some more virulent.

## Pet Cat to Human Spillback:

Dr. Hardy has cautioned, over the past 2 years, of possible SARS-CoV-2 **spillbacks** from pet cats. There have been numerous worldwide reports of infected cat owners infecting their cats, in fact there were 126 outbreaks in cats by May of 2021, more than a year ago.<sup>11</sup> Now such a **spillback** from an infected pet cat has occurred, in Thailand, to a 32-year-old healthy female veterinarian.<sup>10</sup> The cat was presented to the veterinary hospital of the Prince of Songkla University by a 32- and 64-year-old son and father from Bangkok. The cat had a history of fever, clear nasal discharge, and a productive cough for the past 2 days. The female veterinarian obtained nasal and rectal swabs while 2 other veterinarians restrained the cat.



During the 10-minute procedure, the cat sneezed in the face of the veterinarian while she was obtaining the nasal swab. She and the other veterinarians were wearing disposable gloves

and N95 masks but no face shields or eye goggle protection.

Three days later the female veterinarian became symptomatic, but did not seek medical attention, until 5 days later, when the RT-PCR results from the cat were positive. During this time period, July-September, 2021, the COVID-19 SARS-CoV-2 was transitioning from the Alpha variant to the Delta variant. The veterinarian then tested positive for SARS-CoV-2 by PCR. The examining veterinarian did not have any close contacts that were diagnosed with COVID-19 so the cat was the only source of the virus.

The SARS-CoV-2 genetic sequences were identical to the 2 cat owners, their cat and the infected examining veterinarian. Such **spillbacks** may be uncommon from cats due to the relatively short duration (median 5 days) that cats shed viable virus.<sup>12-14</sup> The evidence seems clear that SARS-CoV-2 was transmitted from one of the infected owners to the cat, and then from the cat to the veterinarian. Another important finding is the likelihood that the infection occurred through the eye conjunctiva rather than as an aerosol through the respiratory tract.

This report suggests that eye protection, as part of the standard personal protection, is advisable for pet owners, caregivers and veterinary hospital personnel, during close interactions with cats suspected to be, or known to be infected.

Until recently there has not been a single case of SARS-CoV-2 **spillback** to people, nor the evidence of spread and adaptive circulation of the virus among pet cats.<sup>11,15</sup> However, there is a need to examine SARS-CoV-2 occurrence in feral or stray cats. Such studies have not yet been done.

## SARS-CoV-2 Infected FeLV Infected Pet Cat:

Another recent study reported an FeLV-infected pet cat that was coinfecting with a Gamma SARS-CoV-2 variant of concern P.1.<sup>16</sup> This finding is disturbing in that it shows the potential of immunocompromised FeLV-positive cats to

become a reservoir for the generation of new SARS-CoV-2 variants. Similar concerns occur when immunosuppressed people are infected with SARS-CoV-2 as they are also usually infected longer, due to their immunosuppression. This can allow for the generation of more variants than do non-immunosuppressed people who can clear their infections more quickly. A very interesting study, lead by Sue VandeWoude, who previously did research into feline leukemia virus, found that SARS-CoV-2 infection in animals can lead to rapid adaption of the virus to their new animal hosts resulting in rapid viral evolution with generation of variants.<sup>4</sup> This is concerning in regard to possible **spillback**, especially if it occurs in species such as cats and dogs, who live in close frequent contact with people. In this regard, there is now evidence that SARS-CoV-2 reverse zoonosis can occur from infected owners to their pet cats and dogs through food sharing (vomites), the sharing of leftover human food with pets.<sup>17</sup>

## The One Health Approach:

CDC's One Health Office leads the agency's One Health efforts in the United States and abroad. "One Health is a collaborative, multisectoral, and transdisciplinary approach—working at the local, regional, national, and global levels—with the goal of achieving optimal health outcomes recognizing the interconnection between people, animals, plants, and their shared environment."<sup>18,19</sup> The One Health Approach, as seen by many, has only been descriptive so far. A recent publication describes the One Health disparities of COVID-19 disease transmission: exposure, susceptibility, and disease expression. These are caused by biological and social factors, such as diabetes and obesity, and by variation in access to healthcare.

## Present Pandemic Statistics<sup>20,23</sup>

### As of 8-10-2022

#### Worldwide WHO:<sup>20</sup>

Worldwide SARS-CoV-2 Infections: 584,065,952

Worldwide deaths from COVID-19: 6,418,958

#### USA: CDC: <sup>21</sup>

USA SARS-CoV-2 Infections: 92,296,142

USA Deaths (most in the world) 1,030,010

Average new daily infections (cases) 107,077

Average new daily deaths 395

A recent analysis by the Kaiser Family Foundation estimated that 60% of all adult COVID-19 deaths in the United States since June 2021, **could have been prevented 234,000** by vaccination with just the primary series alone (no boosters).<sup>24</sup> On a per capita basis in descending order: Mississippi, Arizona, Oklahoma, Alabama, West Virginia, Arkansas, Tennessee, Louisiana, New Jersey, and Michigan experienced the most COVID-19 deaths per 100,000 residents while Hawaii, Vermont, and Puerto Rico reported the lowest number per capita.

## Commentary by Dr. William D. Hardy, Jr.:

On a happier note, June 1, 2022 was The National Veterinary Laboratory's **50th anniversary!** Yes, 50 years, one-half century ago, we started the lab in my garage in New Jersey. To our knowledge, we are the oldest private veterinary diagnostic laboratory in the United States. We are a specialty lab testing for only "the 3 common cat pathogens" FeLV, *Bartonella* and FIV. We thank the 5,169 veterinary hospitals that have used our services.

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