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## There is Light at the End of the COVID-19 Tunnel: But We Are Not There Yet! **SARS-CoV-2 Variants**



These is a light at the end of the COVID-19 Tunnel



But, before COVID-19 is over and we can congregate again



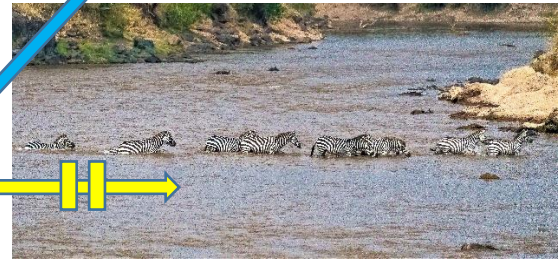
SARS-CoV-2 variants must be controlled



Vaccinated- achieve “Herd Immunity”



**SARS-CoV-2**  
Vaccine



30% will not accept vaccination

SARS-CoV-2 diagram Alissa Eckert, MS; Dan Higgins, MAM - This media comes from the Centers for Disease Control and Prevention's Public Health Image Library (PHIL), with identification number #23312. All other pictures by Dr. WD Hardy, Jr.®

**COVID-19 Tunnel:** We are still in the Covid-19 tunnel and the SARS-CoV-2 variants may slow or prevent us from getting through the tunnel as soon as we wish, because there have not been enough people vaccinated so far and thus, we have not reached the desired herd immunity. As of April 10, 2021 data from the John’s Hopkins COVID Center global cases are 135,202,387, global deaths are 2,926,967, US confirmed cases are 31,150,876, US deaths are 561,782 and there were >86,000 new US cases daily last week.<sup>1</sup> On an encouraging note, there have been 117,142,879 one dose vaccines given (35.3% of the population), and 70,692,645 fully vaccinated people in the US (21.3% of the population). The highest risk population of >65 years-old, 78.1% received one dose and 60.6% are fully vaccinated, however the tide of infection is turning toward younger people. The UK variant B.1.1.7 is the most common variant in the US and occurs in 27.2% of new infections. The world may be relaxing restrictions too early and not waiting for more herd immunity from vaccinations as there are presently major surges of infections in Europe and the US again.

Although the vaccines are here, prepared from the original SARS-CoV-2 isolate, early studies show that some vaccines are less able to completely protect against the new variants. In addition, there are now reports that cats and dogs have been infected, from their owners, with the highly transmissible UK B.1.1.7 variant and, it is only a matter of time that they will also become infected by some of the dozens of other variants now circulating.

### **SARS-CoV-2 Variants:**

A viral variant means that a mutation has occurred in the virus over time just like natural evolution. As the virus infects people, it replicates its genome and, every time it replicates the genome there are chances for errors or mutations to occur. Multiple mutations can arise during persistent infections of immunocompromised people, especially when the virus develops escape mutations under selective pressure of antibody or convalescent plasma treatment, the same deletions in the surface antigens can recur in different people. There are troubling consequences of emerging variants

which may be increased transmissibility, morbidity and mortality and there may also be decreased susceptibility to antiviral drugs and neutralizing antibodies or convalescent plasma. Variants may evade natural immunity and be able to cause reinfections and also may have the ability now to infect vaccinated individuals. One theory of the possible origin of variants may be that chronically ill patients, treated with convalescent plasma or monoclonal antibodies, may have had lengthy illnesses in which the virus had more opportunity to replicate, increasing the odds for mutations.

**Herd Immunity:** When the COVID-19 SARS-CoV-2 virus emerged, virtually nobody was immune and it spread quickly due to the lack of resistance. Halting the spread will require a significant percentage of people to be immune, herd immunity.<sup>2</sup> When most of a population is immune, this provides indirect protection. For example, if 80% of a population is immune to a virus, four out of every five people who encounter someone with the virus won't get infected or get the disease and will not spread the disease. Depending how contagious an infection is, usually >70% of a population needs immunity before infection rates start to decline.

We have herd immunity in veterinary and human medicine. Distemper, rabies, and leptospirosis in veterinary medicine and measles, mumps, polio, chickenpox among others in human medicine are some examples of infectious diseases that were once very common, but are now rare in the U.S. because vaccines helped to establish herd immunity. This is a proven concept in animals and humans. Yet presently it is so complicated due to misinformation, as about 30% of Americans say they will not take the vaccine to keep the rate of infection down without restrictions on activities.

### **SARS-CoV-2 British Variant B.1.1.7 Now Found in Cats and Dogs:**

Yes, as anticipated, since cats and dogs have been infected with the original virus, some cats and dogs now have been infected with the SARS-CoV-2, UK B.1.1.7 variant.



**Myocarditis:** The largest study found an association with myocarditis in naturally infected pet cats and dogs with the British variant of SARS-CoV-2. At the Ralph Veterinary Referral Center in Buckinghamshire England, veterinarians noticed a surge in the proportion of cats and dogs admitted for myocarditis.<sup>3</sup> The animals had congestive heart failure including lethargy, rapid breathing, shortness of breath, and the lack of appetite as well as severe life-threatening arrhythmias. At the same time, the UK variant was increasing dramatically in the human population in the area. Of the 11 animals with myocarditis studied, two cats and a dog tested positive for the UK variant by PCR and an additional two cats and a dog had antibodies against the virus. The study has not yet been peer-reviewed and the authors claim only an association, not a cause.<sup>3</sup>

Two other studies were reported, one from four households in Argentina, and a dog and cat living in the same household in Texas. In 4 households in Argentina, 4 dogs and one cat tested positive. In the Texas household, an owner in the household had COVID-19 and a dog and a cat tested positive for the SARS-CoV-2 UK variant. None of these animals showed any clinical signs.

These observations are concerning, from the reverse zoonosis standpoint as well as for the possible generation of additional mutant strains of the virus in a non-human host. Such mutations may be more problematic when developing in a different species. In addition, cats have a well-known coronavirus associated with the disease feline infectious peritonitis. Also, there is an enteric coronavirus of cats that mutates into the FIP virus which then causes the deadly disease in cats. One concerning scenario may be when cats developed the FIP disease along with that mutant feline FIP coronavirus, what would be the consequence of those cats being super-infected with the SARS-CoV-2 UK variant from humans and, the result of that co-infection, being yet a different and possibly more lethal mutant coronavirus?

### **Conclusion:**

**Experimental studies show that cats are more susceptible than dogs to SARS-CoV-2 and they can transmit the virus to other cats by aerosols. Veterinarians must warn owners in households, where persons have COVID-19, to avoid contact with their pet cats and dogs until their infections are over. Until additional studies have been completed, veterinarians cannot be certain that infected cats or dogs cannot transmit the SARS-CoV-2 virus back to people and act as a reservoir, vector or fomite (reverse zoonosis). We still need more vaccinations, need to keep social distancing and mask wearing for several more months until we reach at least the 70% herd immunity goal (preferably a 90+% goal).**

### **References:**

1. <https://coronavirus.jhu.edu/data>. April 10, 2021.
2. D'Souza, G. and Dowdy, D [www.jhsph.edu/covid-19/](http://www.jhsph.edu/covid-19/) April 10, 2021.
3. Ferasin, L., et al. Myocarditis in naturally infected pets with the British variant of COVID-19. bioRxiv preprint doi: <https://doi.org/10.1101/2021.03.18.435945>; this version posted March 18, 2021.