

# COVID-19 Exposure in Working Equines-A Longitudinal Study

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## ABSTRACT

Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), also known as coronavirus infectious disease 19 (COVID-19) is known to infect multiple animal species, including equines. The annual economic impact of the equine industry is significant – involving some \$300 billion dollars and 1.6 million full-time jobs globally with a worth of \$16 billion in Canada<sup>9</sup>. The ability of horses to carry the SARS-CoV-2 virus is therefore of economic and public health interest. In this longitudinal study, four equines in a competitive hunter barn were monitored over a period of three years for the presence of COVID-19 by oral swab. Despite exposure to large numbers of people and other equines, no animals tested positive for COVID-19. This study suggests that the risk of transmission of COVID-19 in a competitive hunter barn setting is low.

## Introduction

The new coronavirus, Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2), also known as coronavirus infectious disease 19 (COVID-19), was noted by health workers in December 2019 when a cluster of people who attended a seafood and animal market in Wuhan, Hubei Province, China presented with a severe respiratory illness<sup>1</sup>. The outbreak quickly spread and within three months was declared a pandemic, with cases reported in nearly 200 countries in all regions of the world. As of August 2020, a cumulative total of nearly 25 million cases and 800 000 deaths have been reported worldwide since the start of the outbreak<sup>2</sup>. To date, only seven coronaviruses have been reported in humans, four of which are ubiquitous with seasonal circulation and mostly causing relatively mild colds (HKU1, NL63, OC43 and 229E). The other three of more recent zoonotic origin, are associated with severe acute respiratory syndromes, namely SARS-CoV, MERS-CoV and now SARSCoV-2<sup>3</sup>. The diversity of species susceptible to SARS-CoV and SARS-CoV-2 related viruses strongly suggests a propensity of these viruses to cross the species barrier<sup>1</sup>.

To date, viral RNA from SARS-CoV-2 has been detected in domestic dogs and cats, with cats being susceptible to symptomatic infection<sup>4</sup>. Symptomatic infections were also reported in four tigers and two lions at the Bronx Zoo in New York City, and testing confirmed they were SARS-CoV-2 positive. The big cats had been exposed to a zookeeper who was COVID-19 positive and actively shedding the virus, indicating occurrences of reverse-zoonotic transmission<sup>5</sup>. Most recently, minks in Denmark were found to carry SARS-CoV-2 variant that was transmissible to humans<sup>6</sup>.

The annual economic impact of the equine industry is significant – involving some \$300 billion dollars and 1.6 million full-time jobs globally with a worth of \$16 billion in Canada<sup>9</sup>. In Ontario alone, in 2016, there were an estimated 251,690 horses and 36,246 horse facilities<sup>10</sup>. Tens of thousands of Canadians are regularly exposed to horses, including Canadians with physical disabilities who participate in therapy riding and may be particularly vulnerable to SARS-CoV-2 due to their physical impairments. The ability of horses to carry the SARS-CoV-2 virus is therefore of economic and public health interest.

In equines, a case study published in 2022 demonstrated close temporal seroconversion of a horse exposed to an infected owner.<sup>7</sup> The horse remained asymptomatic. Another study conducted between 2020-

2022 examined the seroprevalence of SARS-CoV-2 among 1186 equines presenting to a teaching veterinary hospital.<sup>8</sup> Overall, 3.5 % of horses were seropositive for SARS-CoV-2, and horses with medical and surgical complaints were more likely to test seropositive to SARS-CoV-2 suggesting more frequent and/or longer interactions with individuals with COVID-19. Finally, a third study looked for seropositivity to SARS-CoV-2 in both sick and healthy equines<sup>9</sup>. They found no evidence for SARS-CoV-2 in the sick equines, and the prevalence of SARS-CoV-2 IgG antibodies in healthy racehorses in their study was 5.9%. They concluded that SARS-CoV-2 causes subclinical disease in horses, and that equines can seroconvert with frequent exposure to infected humans. To date, no study has followed an equine with serial testing over time to monitor for seroconversion from routine exposure to human contact.

## Methodology

Four hunter horses residing in a large show and lesson barn in Ontario, Canada, participated in the study. Potential subjects were drawn from a pool of equines available for lease within a 400 km radius of the home facility. Inclusion criteria included an equine in good health, immunized against common diseases including equine influenza, and expected to live for at least 5 years. The equine had to be eligible to be ridden in lessons and competitive shows to maximize exposure to as many human and equine contacts as possible. Exclusion criteria included baseline reactive airway disease, underlying cardiac or inflammatory conditions, or requirement for regular systemic steroid or other immunosuppressive medications. Horses were housed in a stable with 36 other equines. They were regularly exposed to 4 staff members, 13-20 boarders, numerous lesson students and their parents, as well as equine care professionals. In addition, equines regularly attended shows where they were potentially exposed to as many as 500 horses and over 1000 humans. The first equine was followed for 8 months, then became unrideable due to a non-healing ulcer. The second equine was followed for 5 months. The subsequent two horses were followed for 12 months each. All horses received standard equine daily care and regular standard veterinary care. Monthly oral swabs were collected and also performed a week after attendance at any horse show or after the equine had any significant interaction with a large group of humans or equines. The results were monitored for the presence of SARS-CoV-2. The horses were monitored for respiratory symptoms and received veterinary care as appropriate. Initial testing used commercially available viral swabs (Yocon (Bionuclear) Kit (STC-110)) were collected and sent to the provincial virology lab for PCR testing. Ten months into the study, SARS-CoV-2 testing was converted to rapid antigen testing using the BTNX Inc. Rapid Covid-19 Antigen test kit. This kit is an invitro immunochromatographic assay for the direct and qualitative testing for SARS-CoV-2 from nasal and nasopharyngeal secretions approved by Health Canada. Compared to PCR, the rapid antigen test has a relative sensitivity of 94.55%, a relative specificity of 100%, and an overall agreement with PCR of 98.61% according to the product monograph, although swab sensitivity may be as low as 85% when used orally as opposed to nasopharyngeal swabbing. The change in testing was due to ease of use and widespread availability of the testing kit as well as to the limitation of provincial PCR testing to high-risk patient groups. Monitoring was conducted over a three-year period.

## Results

No equine tested positive for SARS-CoV-2 during the study period despite regular exposure to large numbers of equines and humans. All animals were exposed to the barn staff and a rider and trainer, as well as to other barn boarders, lesson students, and school break campers. Equines received regular veterinary, dental, and farrier care as well as visits from a massage therapist on a regular basis. Equines attended horse shows with up to 500 equine participants, with their riders and support staff during the spring and summer months. At shows, the equine also had contact with a professional braider who worked with multiple horses. The equines had

several episodes of respiratory symptoms during the study period, including one case of pneumonia treated with antibiotics, but viral testing was negative after each episode. There were several confirmed cases of SARS-CoV-2 among barn boarders and lesson students, but no known human SARS-CoV-2 outbreaks related to any of the shows attended.

## Discussion

The results of this longitudinal study suggest that, although SARS-CoV-2 can be carried by equines and transmitted from human to equine, the risk of transmission in a competitive hunter barn is low, even with significant potential exposure opportunities. This is reassuring, as the equine industry is a significant economic contributor in Ontario. Further, equine therapy is commonplace for individuals with disabilities who may be at higher risk from SARS-CoV-2 infection.

This study has several limitations. Firstly, unlike some other studies in this area, testing was solely by oral swab as serum antibody testing was not available to the authors, thus exposure to the virus may have been missed. Viral swabs have a high sensitivity however, and it is likely that repeated testing would have revealed exposure. Secondly, the aggressive Canadian response to the Covid pandemic, with repeated provincial lockdowns and the encouragement of enhanced hygiene and distancing measures may have made COVID-19 exposure less likely than in the US experience. Further longitudinal follow-up now that the virus has reached a steady state and become endemic may give a better indication of transmission risk, especially with the removal of all COVID-19 related societal restrictions. In addition, routine COVID testing of the rider could help to determine if clinical or sub-clinical infection of the rider exists and would help to quantify the risk of transmission between human and equine.

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