

Apartment buildings in Guangzhou, China, where toilet waste pipes may have carried the novel coronavirus from one infected family's bathroom to people living above them.

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Can you catch COVID-19 from your neighbor’s toilet?

By Jocelyn Kaiser
Sep. 4, 2020 , 5:05 PM

***Science*'s COVID-19 reporting is supported by the Pulitzer Center and the Heising-Simons Foundation.**

Coronaviruses wafting through a Chinese apartment building’s plumbing may have infected some residents, according to a new study, raising fears of yet another way that COVID-19 could spread. The case echoes a 2003 outbreak of severe acute respiratory syndrome (SARS) that spread through the pipes of a Hong Kong apartment building—and some worry that transmission via toilets might have contributed to the COVID-19 outbreak that shut down New York City early in the pandemic.

The study adds to months of warnings that SARS-CoV-2, which causes COVID-19 and is thought to spread mainly through respiratory droplets and aerosols, could also infect via feces. “It’s not something that people like to talk about,” buildings expert Joseph Allen of the Harvard T.H. Chan School of Public Health **wrote in a *Washington Post* op-ed this week**.

Related

Although fecal transmission of a pathogen is tricky to confirm—and proving that a virus spreads via building waste pipes is even more difficult—it is entirely possible, several researchers tell *Science* Insider. With their help, we try to answer some key questions about this unusual and still speculative risk.

Can people catch COVID-19 from poop?

A number of studies have reported finding RNA from SARS-CoV-2 **in fecal samples from COVID-19 patients**. Some of those patients also had diarrhea, suggesting the virus had infected their intestinal tracts; the RNA could also come from swallowing saliva or respiratory tract fluids containing the virus. Such fecal samples inspired wastewater testing currently being used to watch for incipient COVID-19 outbreaks in cities around the world and at **some U.S. universities**.

Some studies have also found abundant coronavirus RNA in **hospital bathrooms**, and one modeling study suggested that flushing a toilet can **spew viral particles far above the seat**. A person could therefore be exposed to SARS-CoV-2 by breathing aerosolized fecal matter, or by ingesting the virus after touching a contaminated surface.

A key point often glossed over, scientists say, is the limited evidence that viral RNA in stool comes from live, infectious viruses—not just leftover material from "dead" or destroyed viruses. Only a few labs have reported culturing live virus from COVID-19 patient stool samples, which is challenging to do. One team has suggested that **intestinal fluid neutralizes the virus**. The U.S. Centers for Disease Control and Prevention says "it is unclear" whether virus in feces can cause COVID-19 and concludes the risk of spreading the virus this way is "low." To date, there are no documented cases clearly indicating infection via fecal matter.

But Allen and other researchers say the risk should not be ignored. Many animal coronaviruses can be spread through feces, "so it isn't a stretch to believe it might be possible with SARS-CoV-2," says epidemiologist Susan Amirian of Rice University.

But whether that risk is present in sewage is another question. By the time human waste reaches a typical sewer outfall or treatment plant, any potentially intact viruses are likely too diluted to be infectious, says environmental engineer Jordan Peccia of Yale University, who is testing wastewater for SARS-CoV-2 in Connecticut. To date, there is little to no evidence that COVID-19 spreads via sewage.

What about that 2003 SARS outbreak in Amoy Gardens?

Amoy Gardens, a Hong Kong housing complex with multiple apartment towers, saw 321 residents catch SARS in 2003; 42 of them died. Researchers traced the outbreak to **a single visitor with SARS who had severe diarrhea**. The bathrooms in the apartments had floor drains for cleaning, and when the U-shaped traps beneath these drains dried out, aerosolized SARS virus from the sick resident reached apartments through an air shaft. Typically, such wafting is blocked by water that has accumulated in the traps. Scientists suggested the wind even carried the aerosols to adjacent buildings.

How does Amoy Gardens compare with the new COVID-19 cases in the Chinese apartment building?

Just nine people got sick from SARS-CoV-2 in Guangzhou, where the apartment building was located, and none died. But there are similarities, says University of Hong Kong mechanical engineer Yuguo Li, who studied both cases. Li's group—along with teams from the Guangdong Provincial Center for Disease Control and Prevention and Guangzhou CDC—**describe their new findings** this week in the *Annals of Internal Medicine*. (China CDC mentioned the cases in less detail in a **paper published late last month**, as **first reported by Bloomberg**.)

Here's what is known about the COVID-19 episode: All five members of a family living in a 15th floor apartment tested positive for SARS-CoV-2 in late January, after most of them had visited Wuhan, where the pandemic started. A few days later, two middle-aged couples living on the 25th and 27th floors—part of a stack of vertically arranged apartments directly above the flat in question and all sharing the same waste pipes—became ill. They had not traveled or been in close contact with a sick person during China's lockdown.

Li's team compiled a range of evidence suggesting the two couples were exposed to fecal aerosols from their neighbors more than 10 floors below through their shared waste pipes. Camera footage from elevators indicated that the families did not cross paths. Among more than 200 air and surface samples collected in the high-rise in mid-February, the only ones testing positive for SARS-CoV-2 came from the 15th floor family's apartment and a vacant apartment's bathroom on the 16th floor directly above. Finally, a tracer gas that Li's team piped into the 15th floor apartment's drainpipe exited in the 25th and 27th floor apartment bathrooms.

The researchers could not verify that any of the three U-shaped traps in the apartments had dried out when the COVID-19 cases happened, however. The apartments had already been cleaned and the traps filled with water when they visited. Evidence for spread via plumbing remains "circumstantial," they write. Still, Li's team tells "a compelling story," Peccia says.

Li says he's aware of three similar cases of possible SARS-CoV-2 transmission via high-rise plumbing, two in Hong Kong and another in Guangdong province. He's investigating one of the Hong Kong cases, which involved five stacked apartments. "We really do not know" how many other cases there may be in China or elsewhere, he says.

Could COVID-19 have spread through plumbing in New York City high-rises?

That depends on many factors and may be impossible to prove, researchers say. A sick person would have had to produce lots of infectious virus, which would have had to reach others quickly and at a high dose, Peccia says. "A lot has to fall in line."

It would also depend on a building's plumbing system and how well it was maintained. In the United States plumbing systems generally "protect people," says Michael

Gormley, a water sanitation expert at Heriot-Watt University in Edinburgh, who **wrote a commentary** on Li's study. One difference in New York City is that most apartment bathrooms don't have floor drains. But even so, there are other drains with U-shaped traps, like those in unused bathtubs, that could dry out.

"There's no reason it couldn't happen," Peccia says. But if it does, he suspects "it's a rare event."

What's the bottom line for apartment building dwellers, and people in general?

There are several steps people can take to reduce their exposure to such fecal aerosols, Gormley and others say. Chief among them is good hygiene—washing hands, cleaning the toilet, and keeping the lid down when flushing. If you live in a high-rise apartment building, make sure U-shaped traps are filled—that's easily done by regularly running water in tubs and sinks. But gases can also leak from aging pipes, Li notes. "If [you] can smell the drain odor in your bathroom, do something."

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Mink Farm Tests Positive with SARS-CoV-2

LANSING, MICH. The Michigan Department of Agriculture and Rural Development (MDARD) confirmed the recent discovery of SARS-CoV-2 (the virus that causes COVID-19 in humans) in mink at a Michigan farm. While this finding is not the first case of the virus being identified in mink in the United States, it is the first instance of the virus being confirmed among Michigan's farmed mink population.

After several mink exhibited signs of illness and died on the farm, the owner submitted samples for diagnosis. The Michigan State University Veterinary Diagnostic Laboratory completed necropsies on two of the affected animals, which tested presumptive positive for SARS-CoV-2. The samples were then sent to the United States Department of Agriculture's (USDA) National Veterinary Services Laboratories for confirmatory testing.

Investigations into how the mink contracted the virus are ongoing, but there is currently no evidence that animals, including mink, play a significant role in spreading the virus to humans in Michigan. The Michigan farm is self-contained, has few staff, and prohibits domestic animals from being onsite, so the likelihood of the virus moving to wildlife, pets, or people is quite low. MDARD is working in cooperation with other local, state, and federal agencies on this response.

On August 17, 2020, the USDA announced the first confirmed cases of SARS-CoV-2 in mink at farms in Utah. There has also been a confirmed case in Wisconsin. Worldwide, it has been known that mink are susceptible to SARS-CoV-2 since the virus was discovered in mink on farms in the Netherlands, Denmark, and Spain. After monitoring the outbreaks abroad, USDA, the Centers for Disease Control and Prevention, and state animal health and public health partners issued guidance for those who farm mink in the United States.

For more information about COVID-19 and animals, please visit the CDC's COVID-19 and Animals webpage.

Information around this outbreak is changing rapidly. The latest information is available at Michigan.gov/Coronavirus and CDC.gov/Coronavirus.

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Wisconsin Veterinary Diagnostic Laboratory
UNIVERSITY OF WISCONSIN–MADISON

Cleaning and Disinfection of Livestock Pens and Buildings

High Pressure Washer: Utilized

Donald C. Sockett DVM, MS PhD

Diplomate ACVIM

12-01-20

It is important that livestock barns be properly cleaned **before** the disinfectant is applied. If the barn is not properly cleaned; the disinfection step is much less effective at killing disease causing microorganisms. Whenever possible, high pressure washing **should not** be used because of the risk of cross-contamination of the environment. However, when surfaces are heavily soiled with organic material it may be necessary to do both high and low pressure washing. Livestock owners and managers should understand that while high pressure washers do remove gross soils such as dried fecal material it **does not** consistently and efficiently remove the biofilm layer. Biofilm disruption and removal is an essential and vital component of proper cleaning because greater than 90% of disease causing organisms are housed in the biofilm layer.

1. **Remove all the bedding material**
   After the bedding material has been removed, a barn broom should be used to sweep up the remaining feed, dust and organic debris.

2. **Soak with water for 1-2 minutes: Warm water (≥ 90 -100 °F is preferred but not obligatory)**
   Thoroughly wet all the surfaces using a garden hose. The water should be applied from high to low starting at the highest point in the building and ending at the lowest point such as the floor drain.

3. **Alkaline foam cleaning: Hot water (≥ 135 °F is preferred but not obligatory)**
   This procedure is obligatory for biofilm disruption and removal. It is the **most important step** in the cleaning and disinfection process. Apply an alkaline (pH 11-12) foaming detergent (Total Alkaline Presoak™, Triton Chemical, Lakeville, MN) to the building using a hand-held airless foamer (Lafferty Compact Model 25 Airless Foamer, Lafferty® Equipment Manufacturing Inc., Little Rock, AR). Fill the 32 ounce bottle with the concentrated alkaline foaming detergent and insert the Burgundy colored metering tip (10 ounces of detergent/gallon) in the lid of the foamer. Start at the lowest point of the barn and finish at the highest point. Apply the alkaline foaming detergent evenly.

4. **Soak** ≥ 5-10 minutes
   Do not allow the foaming detergent to dry.

5. **Rinse**
   Rinse thoroughly with cold water using a garden hose going from the highest point to the lowest point of the barn.

6. **Disinfection**
   Fill the 32 ounce bottle for the hand held sprayer (Compact model 20 or 50 airless sprayer, Lafferty® Equipment and Manufacturing) with a 3,000 ppm concentrated solution of chlorine dioxide. Insert the dark purple metering tip in the lid of the sprayer. The working solution of chlorine dioxide will be approximately 400 ppm. Prior to use, it is obligatory that the working concentration of chlorine dioxide is verified with plastic test strips (Insta-Test®, high range chlorine dioxide, La Motte, Chestertown, MD). Disinfect the livestock barn going from the highest to lowest point. There should be a **minimum** of 3-5 minutes of contact time. When using chlorine dioxide at concentrations of ≥ 200 ppm, operators should wear protective eyewear and an R95 approved particulate respirator mask that is carbon lined (grey color).

7. **Dry**
   Allow the surfaces to dry.

8. **Power wash with cold water.** Go from high to low making sure the organic material is removed.
   .

9. **Dry**
   Allow the building to completely dry out.

10. **Disinfection**
    Twelve to 24 hours prior to filling the barn, disinfect with cold water. Fill the 32 ounce hand sprayer bottle (Compact model 20 or 50 airless sprayer, Lafferty® Equipment and Manufacturing) with a 3,000 ppm concentrated solution of chlorine dioxide. Insert the pale pink metering tip in the lid of the sprayer. This will yield a working solution concentration of 250 ppm. Verify that the working concentration of chlorine dioxide is correct using plastic test strips (Insta-Test®, high range chlorine dioxide, La Motte, Chestertown, MD) prior to use. Disinfect the barn going from the highest to lowest point in the barn. When using chlorine dioxide at concentrations of ≥ 200 ppm, operators should wear protective eyewear and an R95 approved particulate respirator mask that is carbon lined (grey color).

Personas que trabajan en criaderos de visones: Prevengan la propagación del COVID-19

El SARS-CoV-2, el virus que causa el COVID-19, puede propagarse entre las personas y los animales, incluso los visones. Los visones se infectan muy fácilmente con el SARS-CoV-2.

Cualquier persona en el criadero puede propagar el SARS-CoV-2 a otros trabajadores y animales. Tomen precauciones para prevenir la propagación del SARS-CoV-2 entre las personas y los animales en los criaderos de visones.

- Cuando interactúen con visones u otros animales sanos:
  - » pónganse una mascarilla o un respirador N-95 al que se le haya hecho una prueba de ajuste, si hay uno disponible, protección para los ojos, prendas exteriores de uso exclusivo para el trabajo, guantes, y
  - » minimicen la cantidad de tiempo que pasen en contacto cercano con los visones y otros trabajadores.
- Si están enfermos, han estado expuestos al COVID-19 o han recibido un diagnóstico de COVID-19, no trabajen con los visones a fin de prevenir la propagación del virus a los animales.

Protejan a los visones del SARS-CoV-2

- Quédense en casa si están enfermos.
- Evalúen a los trabajadores y visitantes para ver si tienen COVID-19. Pregúntenles sobre los síntomas y tómenles la temperatura al comienzo de cada turno o cuando las personas lleguen al criadero.
- Separen de las demás personas y de los animales a los trabajadores que lleguen enfermos al criadero o que se enfermen durante la jornada de trabajo, y envíenlos a su casa.
- Exijan el uso de mascarillas y equipo de protección personal (EPP) cuando los trabajadores interactúen con todos los animales, incluso si no se sienten enfermos. Usar una mascarilla **NO** remplaza la necesidad de practicar el distanciamiento social.
- Fomenten la higiene de las manos adecuada, como lavárselas por al menos 20 segundos con agua y jabón, y luego secárselas completamente con una toalla de papel, o el uso de desinfectante de manos cuando no haya jabón. Lávense las manos después de tocar a los animales, su comida o sus desechos.
- Limpien y desinfecten con regularidad las superficies que se tocan frecuentemente. Presten mucha atención a las áreas donde se prepara y almacena la comida de los animales. Desinfecten el equipo que se usa para alimentar a los animales lo más seguido posible. No vuelvan a usar la comida que sobre.
- Permitan que solo el personal esencial tenga acceso al criadero y a las instalaciones. No permitan gatos, perros, animales silvestres y aves en las instalaciones del criadero.
- Traten de evitar que se compartan equipos, herramientas o suministros a fin de reducir la propagación del SARS-CoV-2 de los criaderos a otros lugares.
- Tomen medidas extremas de precaución cuando introduzcan un nuevo visón a la manada a fin de evitar la introducción del SARS-CoV-2 al criadero. Al nuevo visón se le deben hacer pruebas de detección del SARS-CoV-2 y el animal debe estar separado del resto por al menos 21 días antes de reunirse con la manada principal.
- Las personas que trabajan en criaderos de visones deben estar atentas a la aparición de signos de enfermedad en esos animales y deben avisarle al supervisor si sospechan que un visón está enfermo. Si se sospecha la presencia del SARS-CoV-2 en los visones, llamen al funcionario de salud animal estatal o a la Oficina de Servicios Veterinarios del Servicio de Inspección Sanitaria de Animales y Plantas del Departamento de Agricultura de los Estados Unidos (USDA). Los signos de la enfermedad en los visones pueden incluir:
  - » Poco apetito
  - » Estornudos
  - » Tos
  - » Secreción de la nariz
  - » Secreción de los ojos
  - » Falta de aire o dificultad para respirar
  - » Diarrea
  - » Falta de energía
  - » Aumento en la cantidad de muertes de visones



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Protéjanse cuando estén cerca de visones enfermos

- **Minimicen el contacto con animales enfermos o muertos.** Si los animales parecen estar enfermos, usen guantes, mascarilla y gafas protectoras o protector facial cuando trabajen con ellos o estén cerca de ellos.
  - » Reduzcan la cantidad de personas que interactúen con cualquier animal que se sospeche que tenga el SARS-CoV-2 o que tenga un resultado positivo en la prueba de detección de ese virus. El personal que tenga contacto con estos animales debe usar protección respiratoria (respirador N95 o superior) en vez de una mascarilla. El personal que tenga mayor riesgo de enfermarse gravemente de COVID-19 no debería trabajar con estos animales.
- **Practiquen buena higiene de las manos.** Siempre lávense las manos de inmediato con agua y jabón por al menos 20 segundos después de hacer lo siguiente:
  - » Tener contacto directo con animales, sus alimentos, suministros o desechos/heces.
  - » Limpiar los desechos de los animales, incluidos sus líquidos corporales o excrementos.
  - » Tocar cadáveres o pieles de animales.
  - » Usar equipo para desollar a los animales y procesarlos.
  - » Salir de las áreas donde se alberga a los animales, aunque no hayan tocado ninguno.
  - » Quitarse el EPP y las mascarillas.
- **Usen una mascarilla y protección para los ojos** (p. ej., gafas protectoras o protector facial) cuando se puedan producir salpicaduras o rocíos.
- **Eviten las actividades que podrían aerosolizar (rociar al aire) material infeccioso** como usar aire comprimido o agua a presión para limpiar.
  - » Si van a participar en procedimientos que generen aerosoles (p. ej., limpieza, partos, desolladura, procesamiento de subproductos), usen protección respiratoria que proteja al menos como un respirador con pieza facial filtrante N95, desechable, certificado por NIOSH y al que se le haya hecho una prueba de ajuste; un protector facial o gafas protectoras, guantes, prendas exteriores protectoras.
  - » Si no hay respiradores N95 disponibles, usen una mascarilla quirúrgica junto con un protector facial que cubra el frente completo (que se extienda hasta el mentón o más abajo) y los costados de la cara.
- **Usen EPP** cuando limpien o desinfecten un área potencialmente contaminada con SARS-CoV-2. Sigan las instrucciones del fabricante para el uso de los productos de limpieza o desinfección. Sigan las recomendaciones sobre cómo ponerse y quitarse el EPP de manera segura.
- **Si la piel expuesta de un trabajador entra en contacto directo, de manera accidental, con un animal enfermo o su orina, heces, sangre, saliva o vómito**, el trabajador debe lavar el área expuesta de inmediato con agua tibia y jabón, por al menos 20 segundos, y notificar a un supervisor. Si la exposición fue a través de los ojos, el interior de la nariz, o la boca, hay que enjuagar el área solamente con agua.
- **Si un trabajador del criadero es mordido, rasguñado o presenta una abrasión** por un animal, producto animal o un objeto contaminado por un animal, hay que lavar el área de la piel expuesta de inmediato con agua tibia y jabón por al menos 20 segundos, avisarle enseguida a un supervisor y contactar a un proveedor de atención médica.
- **Si alguien ha estado expuesto a animales enfermos o a una persona enferma**, debería automonitorearse la temperatura y ver si presenta síntomas por 14 días después del incidente, y no interactuar con los visones durante ese periodo.

Para obtener más información:

Guía y recomendaciones interinas sobre el SARS-CoV-2 para visones y otros mustélidos de criadero (https://www.aphis.usda.gov/publications/animal_health/sars-cov-2-mink-guidance.pdf)

Guía interina para funcionarios de salud animal y salud pública a cargo del manejo de visones y otros mustélidos de criadero con SARS-CoV-2 (https://www.aphis.usda.gov/animal_health/one_health/downloads/sars-cov-2-guidance-for-farmed-mink.pdf)

CDC: El COVID-19 y los animales (https://espanol.cdc.gov/coronavirus/2019-ncov/daily-life-coping/animals.html)

People Working on Mink Farms: Prevent the Spread of COVID-19

SARS-CoV-2, the virus that causes COVID-19, can spread between people and animals, including mink. Mink are very easily infected with SARS-CoV-2.

Anyone on the farm can spread SARS-CoV-2 to other workers and animals. Take precautions to prevent the spread of SARS-CoV-2 among people and animals on mink farms.

- When interacting with healthy mink or other animals:
  - » Wear a face mask or fit-tested N-95 if available, eye protection, dedicated outerwear, and gloves, and
  - » Minimize the amount of time spent in close contact with mink and other workers.
- If you are sick, exposed to COVID-19, or have been diagnosed with COVID-19, do not work with mink to prevent spreading the virus to the animals.

Protect mink from SARS-CoV-2

- Stay home if sick.
- Screen workers and visitors for COVID-19. Ask about symptoms and take temperatures at the beginning of each shift or when people arrive at the farm.
- Separate workers who arrive at work sick or become sick during the workday from other people and animals, and send them home.
- Require masks and personal protective equipment (PPE) when interacting with all animals, even if workers don't feel sick. Wearing a mask does **NOT** replace the need to practice social distancing.
- Encourage proper hand hygiene, such as hand washing for at least 20 seconds with soap and water, then dry thoroughly with a paper towel, or the use of hand sanitizer when soap is not available. Wash hands after handling animals, animal feed, and animal waste.
- Clean and disinfect frequently touched surfaces regularly. Pay close attention to areas where animal feed is prepared and stored. Disinfect feeding equipment as often as possible. Do not reuse leftover feed.
- Limit access to farm and farm buildings to essential personnel. Do not allow cats, dogs, wildlife, and birds in farm buildings.
- Discourage the sharing of equipment, tools, or supplies to reduce spread of SARS-CoV-2 from farms to other locations.
- Use extreme caution when introducing new mink to the herd to avoid introducing SARS-CoV-2 to the farm. New mink should be tested for SARS-CoV-2 and separated for at least 21 days before joining the main herd.
- People working on mink farms should be alert for signs of disease in mink and should alert a supervisor if they suspect illness in mink. If there is suspicion of SARS-CoV-2 in mink, call your State Animal Health Official or USDA Animal and Plant Inspection Service Veterinary Services office. Signs of illness in mink may include:
  - » Poor appetite
  - » Sneezing
  - » Coughing
  - » Nose discharge
  - » Eye discharge
  - » Gasping for air or shortness of breath
  - » Diarrhea
  - » Lack of energy
  - » Increase in mink deaths



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CS 321893-A 12/28/2020

Protect yourself around sick mink

- **Minimize contact with sick or dead animals.** If animals appear to be sick, wear gloves, face mask, and goggles or face shield when working with or near the animals.
  - » Reduce the number of people interacting with any animal that is suspected to have or tests positive for SARS-CoV-2. Staff who have contact with these animals should wear respiratory protection (N95 or higher) instead of a facemask. Staff at higher risk for severe illness from COVID-19 should not work with these animals.
- **Practice good hand hygiene.** Always immediately wash your hands with soap and water for at least 20 seconds after:
  - » Direct contact with animals, their food, supplies, or waste/feces.
  - » Cleaning up after animals, including any body fluids or waste.
  - » After handling animal carcasses or pelts.
  - » After using equipment for pelting and processing.
  - » Leaving areas where animals are housed, even if you did not touch an animal.
  - » Removing PPE and masks.
- **Use a mask and eye protection** (e.g. goggles or face shield) when splashes or sprays are likely to occur.
- **Avoid activities that might aerosolize (spray into the air) infectious material** such as using compressed air and/or water under pressure for cleaning.
  - » If participating in aerosol-generating procedures (e.g., cleaning, whelping, pelting, rendering), wear respiratory protection that is at least as protective as a fit-tested NIOSH-certified disposable N95 filtering face piece respirator, a face shield or goggles, gloves, protective outerwear.
  - » If an N95 respirator is not available, use a combination of a surgical mask and a face shield that covers the entire front (that extends to the chin or below) and sides of the face.
- **Use PPE** when cleaning or disinfecting an area potentially contaminated with SARS-CoV-2. Follow the cleaning or disinfectant product manufacturer's instructions for use. Follow recommendations for safe practices for how to put on and take off PPE.
- **If there is accidental direct contact with a sick animal or its urine, feces, blood, saliva, or vomit on exposed skin**, workers should immediately wash the exposed area with soap and warm water for at least 20 seconds and notify a supervisor. If exposure occurs to eyes, inside of nose, or mouth, flush the area with only water.
- **If a farm worker receives a bite, scratch or, abrasion** from an animal, animal product, or an object contaminated by an animal, wash the exposed area of skin immediately with soap and warm water for at least 20 seconds, immediately alert a supervisor, and contact a health-care provider.
- **If someone is exposed to sick animals or a sick person**, they should self-monitor for temperature or symptoms for a period of 14 days after the incident and not interact with mink during this period.

For more information:

Interim SARS-CoV-2 Guidance and Recommendations for Farmed Mink and Other Mustelids (https://www.aphis.usda.gov/publications/animal_health/sars-cov-2-mink-guidance.pdf)

Interim Guidance for Animal Health and Public Health Officials Managing Farmed Mink and Other Farmed Mustelids with SARS-CoV-2 (https://www.aphis.usda.gov/animal_health/one_health/downloads/sars-cov-2-guidance-for-farmed-mink.pdf)

CDC COVID-19 and Animals (https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/animals.html)

From:	Miknis, Robert A - APHIS
To:	Calogero, Jennifer (MDARD); Barr, Nancy (MDARD); Collins, Cheryl (MDARD); Goodrich, Jarold (MDARD); Wineland, Nora (MDARD); Blievernicht, Melissa (MDARD); Styles, Darrel K - APHIS; Rooney, Jane A - APHIS; Wendling, Natalie (CDC/DDID/NCEZID/OD); Peters, Susan (DHHS-Contractor); Blankenship, Heather (DHHS); Carpenter, Ann (CDC/DDID/NCEZID/OD)
Cc:	Schalow, Michele (MDARD); Olander, Doris - APHIS; Signs, Kimberly (DHHS); Stobierski, Mary Grace (DHHS); Soehnlen, Marty (DHHS)
Subject:	RE: Discussion re: Liquid Manure
Date:	Thursday, November 12, 2020 9:34:08 AM

CAUTION: This is an External email. Please send suspicious emails to abuse@michigan.gov

Hello

Received information from colleague of mine. This is an example of what can be used in event of extra storage space is needed. Material can be placed into these bags. The bags will capture solids and can be managed later. The water in the bag will leach out and will have to be managed either back into lagoon or diverted to another imperviable containment. While using this type of storage it was recommended to tarp the bags to prevent precipitation to be managed.

https://www.erosioncontrol-products.com/geotextiletube.html

Respectfully

Rob
-----Original Appointment-----
From: Calogero, Jennifer (MDARD) <CalogeroJ@michigan.gov>
Sent: Tuesday, November 10, 2020 6:13 AM
To: Calogero, Jennifer (MDARD); Barr, Nancy (MDARD); Collins, Cheryl (MDARD); Goodrich, Jarold (MDARD); Wineland, Nora (MDARD); Blievernicht, Melissa (MDARD); Styles, Darrel K - APHIS; Miknis, Robert A - APHIS; Rooney, Jane A - APHIS; Wendling, Natalie (CDC/DDID/NCEZID/OD); Peters, Susan (DHHS-Contractor); Blankenship, Heather (DHHS); Carpenter, Ann (CDC/DDID/NCEZID/OD)
Cc: Schalow, Michele (MDARD); Doris.olander@usda.gov; Signs, Kimberly (DHHS); Stobierski, Mary Grace (DHHS); Soehnlen, Marty (DHHS)
Subject: Discussion re: Liquid Manure
When: Tuesday, November 10, 2020 1:00 PM-2:00 PM (UTC-05:00) Eastern Time (US & Canada).
Where: Microsoft Teams Meeting

Microsoft Teams meeting

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Response & Containment Guidelines

Interim Guidance for Animal Health and Public Health Officials Managing Farmed Mink and other Farmed Mustelids with SARS-CoV-2

9-11-2020

Managing SARS-CoV-2 in Farmed Mink and Farmed Mustelids:

Responder's Interim Guidance

2020

Background

Strategy Components for Dealing with SARS-CoV-2

This document is for animal health and public health officials responding to SARS-CoV-2 outbreaks in farmed mink, and other farmed mustelids.

We are still learning about the SARS-CoV-2 virus, but it appears that it can spread from people to animals in some situations. There is no evidence that animals play a significant role in spreading the virus that causes COVID-19 to people, and the risk of animals spreading COVID-19 to people is considered to be low. More studies are needed to understand if and how different animals could be affected by COVID-19. In dealing with SARS-CoV-2 in animals in the United States, different strategies are being developed and implemented for different animal species. Strategies for dealing with SARS-CoV-2 in mink and other farmed mustelids may be designed with one of three outcomes in mind: 1) prevent the introduction of SARS-CoV-2 into animal agriculture facilities; 2) control losses by minimizing the negative economic and health impact of SARS-CoV-2 when present; or 3) total elimination of SARS-CoV-2 (eradication). Because the virus efficiently replicates in people and multiple animal species, total elimination may not be a realistic goal.

Strategies include:

- Education for farm workers to keep people and animals safe and healthy
- Biosecurity management procedures to prevent introduction or further spread of the SARS-CoV-2 virus
- Diagnostics and surveillance (detection of SARS-CoV-2 infections) in animals
- Elimination of SARS-CoV-2 infected animals

The success of any strategy is dependent on industry–government cooperation and collaboration. The zoonotic nature of SARS-CoV-2 requires One Health coordination among animal health officials, public health authorities, medical professionals, industry, and others to best protect the health of people and animals. This plan outlines procedures for prevention in both workers and mink, handling presumptive and confirmed cases in animals, monitoring infected premises, virus containment, and harvesting/pelting animals from farms that have been infected. This plan also discusses virus elimination on infected premises.

1. Public Awareness and Education Programs Regarding SARS-CoV-2

Education is an essential component of any SARS-CoV-2 prevention, control, or eradication strategy. This involves providing up-to-date information to the industry on what is currently known about SARS-CoV-2 in animals and people; how the virus can be introduced and spread on farms; application of methods and practices in biosecurity to prevent introduction of SARS-COV-2 onto a farm; and biosecurity practices to prevent the SARS-COV-2 virus from spreading between animals and between animals and farm workers.

The Centers for Disease Control and Prevention (CDC) has developed guidance for agriculture workers and employers.

Education and outreach should be continuous and focused on the following people or groups:

- Mink producers
- Mink farm workers
- Veterinarians and veterinary staff working with mink farms
- Fur industry partners
- General public

2. Minimum Biosecurity Plan

Before an outbreak, animal health officials and public health officials should consider offering the following guidance on prevention to mink and farmed mustelid operations in their jurisdictions. All mink farms and other mustelid operations are strongly encouraged to develop farm-specific biosecurity plans that contain elements such as those listed below.

Farm Operators Should Screen Themselves, Workers, and Visitors for COVID-19
Recognizing that human-to-animal transmission is the most likely way that SARS-CoV-2 will enter a mink farm, everyone, including owners, should monitor themselves for signs of infection before entering the farm. People who operate, work on, or visit mink farms and who have symptoms of SARS-CoV-2 when they arrive at work or become sick during the day should immediately be separated from other workers, animals, and other people and be sent home. Everyone who develops symptoms outside of work should avoid contact with animals and other farm personnel and stay home.

Help Farm Workers Follow Prevention Practices for COVID-19
Farms should consult with their state, tribal, local, or territorial health department to devise practices to minimize the risk of SARS-CoV-2 transmission between employees, visitors, other people, and animals. For example, farms should implement strategies and practices in work areas and common areas for people to maintain physical distances of at least 6 feet from other people and animals, where possible. Cloth masks should be worn when maintaining a physical distance of 6 feet from others is not feasible.

Link to practices designed to protect workers from CDC.

Farms Should Practice Good Hygiene and Sanitation
Close attention should be paid to employee facilities such as restrooms, break rooms, and other common areas to ensure appropriate hygiene and sanitation practices are in place. Implement proper

handwashing procedures and sanitation protocols for daily cleaning and disinfection of work and common areas. Configure communal areas so that workers, approved visitors, and others are spaced at least 6 feet apart, if possible. Provide hand washing facilities with soap, potable water, and clean, single-use towels.

Practice strict hygiene in areas where animal feed is prepared and clean and disinfect feeding equipment daily using an EPA-approved disinfectant. Prevent excessive accumulation of animal waste.

Work with Farm Operators to Prevent the Introduction of SARS-CoV-2 into their Animal Facilities
Wherever feasible, consider requiring people who work with or near farmed mink to wear cloth masks and use personal protective equipment (PPE) such as dedicated footwear that can be cleaned and disinfected, dedicated farm clothing such as coveralls, gloves, and eye protection such as face shields or goggles. Work clothing should be laundered on-site and not taken home. Provide training in the proper care and use of PPE.

Information about PPE requirements for high-risk activities is found in Section 10 of this document and additional guidance is provided under the appendix titled "Worker Safety and Monitoring".

Urge Producers to Practice Enhanced Biosecurity
Access to farms should be limited to essential personnel and visitors. Exclude all domestic animals (dogs, cats, etc.), as well as rodents, birds, and other wildlife from farm buildings. Farm operators should restrict access to their property and their animal housing areas. They should use signage to provide guidance to visitors regarding their farm's biosecurity requirements.

At a minimum:

- Use fences, gates, and other barriers to control access to animal housing.
- Require visitors to park their vehicles in designated areas away from animal housing.
- Use signage to advise visitors to remain in their vehicles until farm personnel assist them and provide a phone number visitors can call for entry instructions.
- Maintain a log of all personnel who enter the property (family, workers, visitors, etc.) including the date, contact information, and nature of their visit.
- Provide and wear appropriate PPE depending on the activity being performed. For example, increased PPE for working closely with animals.

Teach Producers Not to Haul Disease Home
Car and truck tires, caging, and equipment can harbor viruses and other germs. Farm personnel traveling to locations where other animals are present should clean and disinfect these items before returning to their own farms. Sharing equipment, tools, or supplies with neighbors or other farms should be discouraged.

Producers Should Use Extreme Caution when Introducing New Mink to the Herd
New animals may introduce disease problems into a mink farm, including SARS-CoV-2. Producers should consult with their veterinarian to design an appropriate isolation plan for new arrivals to protect the rest of their herd. The following precautions are recommended:

- All mink destined to be brought into the herd should come from farms that are historically negative for SARS-CoV-2 and which have no signs of SARS-CoV-2 infection in people or animals involved with that farm.
- All mink in the shipment should be separated from the main herd and be managed separately at least 21 days before the shipment and tested for SARS-CoV-2 at the time of separation.
- All mink mortalities that occur during isolation should be tested for SARS-CoV-2.
- All the separated mink in the shipment should be tested a second time for SARS-CoV-2, at least 21 days after the first testing.
- All the mink in the shipment should test negative for SARS-CoV-2, for the shipment to move forward.
- Upon arrival, the destination farm should isolate the shipped mink from the main herd for at least 21 days.
- During the isolation period the mink should be observed for clinical signs of disease and then retested for SARS-CoV-2 at least 21 days after arrival.
- If all the mink are found to test negative for SARS-CoV-2, the shipment may be introduced into the main herd.

Educate Farm Operators to Report Sick Mink

Early detection is important to prevent the spread of disease. The farm operator and workers should be alert for signs of disease, recognizing that such signs may be subtle changes in animal health, feed consumption, or behavior.

The following signs are common but are not consistently seen in all cases of SARS-CoV-2 in mink.

- Increase in mink deaths
- Sneezing
- Coughing
- Nose discharge
- Eye discharge
- Gasping for air or shortness of breath
- Diarrhea
- Lack of energy
- Poor appetite

If there is suspicion of SARS-CoV-2 in animals, operators should call their State Animal Health Official (SAHO) or United States Department of Agriculture (USDA) Animal and Plant Inspection Service (APHIS) Veterinary Services (VS) office. Farm operators and their veterinarians should save suspicious mortalities for necropsy and testing. Biosecurity training resources should be made available for farm operators and employees in their preferred languages.

Diagnostic Resources

Veterinarians, animal health officials, and farm operators can consult with their state veterinary diagnostic laboratory or one of several private laboratories that are presently providing SARS-CoV-2 PCR and serology testing. North Dakota State University, the Utah State Veterinary Diagnostic Laboratory, the Washington Animal Disease Diagnostic Laboratory, and the Wisconsin Veterinary

Diagnostic Laboratory are recognized for their expertise in diseases of mink. USDA APHIS VS has helpful FAQs on Animal Coronavirus Testing.

3. Procedures for initial handling and investigation of suspected animal cases of SARS-COV-2

- Animal health officials should quarantine affected farms, preventing animals or animal product movement on or off the farm. Using advice from your diagnostic lab, collect samples from suspected animals. In most cases, preferred samples will include oral-pharyngeal swabs or rectal swabs. Unless instructed otherwise by the receiving lab, the swabs should be Dacron-tipped, **not** cotton, and should be transported to the lab in tubes containing viral transport media (VTM), e.g. universal VTM or Brain-Heart Infusion broth (BHI). The mink industry is currently collaborating with diagnostic laboratories to develop effective ELISA serology, so serum samples should also be considered. Consult with your laboratory for advice.
- Start preliminary epidemiologic investigation.
- Quarantine may be instituted at trace-back or trace-forward sites at the discretion of the SAHO.
- Farm operators/managers and animal health officials should collaborate to decide how to manage the buildings housing mink on the farm and whether any should be managed as separate units.
- Determine surveillance sampling strategy for the affected farm, nearby farms, and any farms that appear to be connected epidemiologically.

4. Procedures for reporting animal test results to USDA-APHIS

SARS-CoV-2 is a reportable disease when found in animals. Positive test results should be reported immediately to the SAHO or USDA APHIS VS. All samples that test as *presumptive positive* at state or private laboratories will be forwarded to and confirmed by the USDA APHIS National Veterinary Services Laboratories (NVSL).

5. Quarantine Measures for Presumptive and Confirmed Infected Farms

A mink premises is the location at which the animals are kept. It is a physical address and it will be assigned a premises identification number if it does not already have one.
Key elements for quarantine and monitoring of animals on infected farms include:

- Quarantine infected premises (IP) for all mink and mink products. Maintain the quarantine until the IP is clear of virus. The IP producer should notify the SAHO if morbidity or mortality increases. The IP is required to maintain maximum biosecurity.
- State animal health officials may choose to establish a control zone around an IP, but it is probably more useful to direct surveillance activities to farms found to be epidemiologically linked to an infected farm.
- Monitor surrounding farms, service providers such as renderers or feed suppliers, and movement of animals, equipment, and materials.

6. Provisions for Developing Farm Plans for Infected and Exposed Mink Farms

Three overarching goals should be kept in mind when handling SARS-CoV-2 on an infected or exposed farm:

i. Contain the virus on the farm, preventing spread between animal housing units and to other farms.

ii. Protect workers and visitors from exposure to the virus.

iii. Develop a **farm plan.**

A **farm plan** is a written management agreement between the affected farm operator, USDA APHIS VS, SAHO, and public health authorities. A farm plan sets out the steps to be taken to protect farm workers and public health, prevent introduction of SARS-CoV-2 into other farms, and control SARS-COV-2 on the positive farm. A farm plan should include, but is not limited to, controls on mink and mink product movement, safe handling of conveyances, containers, and other associated materials that could serve as fomites, details plans for increased monitoring, detailed plans for disposal of dead animals, and detailed plans for cleaning and disinfection. Worker protection is crucial, and farms should consult with their state, tribal, local, or territorial health department to implement practices to minimize the risk of SARS-CoV-2 transmission between farm operators, workers, visitors, and others.

7. Disposal Methods for Dead Animals

Always consult local and state authorities prior to disposal activities to assure compliance.

Possible methods include:

- Burial
- Trench burial (where water table is high)
- Incineration
- Composting
- Landfill
- Rendering
- Combination of above methods

Disposal options are discussed and described in depth by USDA APHIS VS at these sites:

- https://www.aphis.usda.gov/animal_health/emergency_management/downloads/nahems_guidelines/disposal_nahems.pdf
- https://www.aphis.usda.gov/aphis/ourfocus/animalhealth/emergency-management/carcass-management/carcass

8. Cleaning and Disinfection

All premises, conveyances, and materials that come into contact with mink infected with or exposed to SARS-CoV-2 should undergo virus elimination procedures before restocking with new animals. The majority of manure and bedding removal can be done before and during pelting. As weather allows, wet cleaning and disinfection may be considered but should be weighed against the possibility that weather conditions could make wet cleaning impractical e.g., freezing temperatures. Dry cleaning combined with a fallow period and the use of sentinel animals prior to full restocking may need to be considered. To accomplish cleaning and disinfection, complete the following procedures:

- **Disposal of manure, debris, and feed**. Clean up all manure, debris, and feed. Compost by windrowing on site if possible. If this is not possible, set up a system for hauling, in covered vehicles, to an approved site for burial, piling, or composting. Clean out the house or move or spread litter. After use, equipment should be cleaned, disinfected, and inspected at the site to which the manure and litter was transported. In the case of inclement weather, the

equipment may be cleaned, disinfected, and inspected at off-site wash stations at the discretion of the SAHO and APHIS.

- **Cleaning of premises and materials.** Cleaning and disinfection should be thorough to ensure that all materials or substances contaminated with SARS-CoV-2 virus, especially feces, dried blood, and other organic materials, are removed from all surfaces. Link to CDC guidance on disinfecting facilities.

9. Provisions for Appropriate Monitoring and Movement Restrictions

Additional surveillance may be conducted at farms or facilities that are found to be epidemiologically linked to the infected premises. The SAHO may impose quarantine and movement restrictions for movement of live and dead animals, and equipment to and from affected facilities. Farm owners and animal health officials should work with public health authorities to provide SARS-CoV-2 health and safety guidance to farms and their workers. The SAHO should inform the state's wildlife agency about the infected farm, so wildlife officials can be alert for disease spread to surrounding wild animal populations. Provide cleaning and disinfection guidelines for people and equipment working with mink in the area.

Minimize the risk of virus spread into uncontaminated areas. Movement, biosecurity, and surveillance in the contaminated area may be modified by the SAHO as needed to contain a SARS-CoV-2 threat.

10. Worker Safety During High Risk Activities on Infected or Suspect Farms

Because mink processing procedures have the potential to spread SARS-CoV-2 and other zoonotic diseases to workers, the following PPE precautions should always be taken when handling carcasses or during pelting:

- CDC resources on PPE
- USDA in-depth discussion of PPE use in animal disease incidents
- Use eye protection (e.g., goggles or face shield) and a National Institute for Occupational Health and Safety (NIOSH)-approved N95 respirator, or higher level of NIOSH-approved respirator whenever splashes or sprays are likely to occur.
- For all PPE, follow manufacturer's directions on use, cleaning, storage, and disposal.
- Avoid aerosol-generating procedures when possible. When there is no alternative to participating in aerosol-generating procedures (e.g., whelping, pelting, rendering), wear a face shield or goggles, gloves, protective outerwear, and respiratory protection that is at least as protective as a fit-tested NIOSH-certified disposable N95 respirator.
    - If an N95 respirator is not available, either use a higher level of respiratory protection or a combination of a properly worn cloth mask or medical mask and a face shield that covers the entire front (that extends below the chin) and sides of the face.
    - Respirator use should be in the context of a complete respiratory protection program in accordance with the Occupational Safety and Health Administration (OSHA) Respiratory Protection standard (29 CFR 1910.134), which includes medical evaluations, training, and fit testing.
- When inside a structure, open as many doors, windows, etc. as possible to maximize natural ventilation.

- Wear gloves and other protective outerwear as needed to avoid bare-skinned contact with animal carcasses, organs, bodily fluids, and pelts.
- Always immediately wash your hands with soap and water for at least 20 seconds after:
  - Direct contact with animal carcasses, organs, or pelts;
  - Cleaning up after animals, including any body fluids or waste;
  - Removing PPE or cloth mask .
- Wearing PPE and certain clothing can often increase your risk for heat-related illnesses. Review CDC information for heat stress prevention for employers and employees.
- Clean tools using an appropriate disinfectant. To disinfect, use products that meet EPA's criteria for use against SARS-CoV-2, diluted household bleach solutions prepared according to the manufacturer's label for disinfection, or alcohol solutions with at least 60% alcohol, and are appropriate for the surface. Follow manufacturer's directions for use.
- PPE such as gloves, face and eye protection, and other types of PPE may be needed when cleaning and disinfecting tools, surfaces, and equipment.
- On farms where there has been a possible SARS-CoV-2 exposure or SARs-CoV-2 has been detected, all animals should be closely observed for signs of the disease, with the understanding that clinical signs are sometimes subtle.
- If possible, pelting should be delayed at least 14 days after the last signs of disease in the affected housing unit. This is particularly important if mink need to be transported off-site for pelting.

11. Surveillance and Monitoring

- All farms, whether pelting occurs on or off-site, should have mink mortalities sampled and tested, at an approved laboratory, by reverse transcription polymerase chain reaction (RT-PCR) to detect SARS-CoV-2. RT-PCR tests need to be negative in the 14 days prior to the start of pelting or movement off-site.
- Mink mortalities should be sampled for testing with a minimum of 5 dead mink collected over more than one day if necessary.
- If there are more than 20 mink mortalities, they can be tested in batches of 20 to minimize costs. If SARS-CoV-2 is found in a batch and confirmed, the testing of the remaining mortalities is not necessary.
- If the minimum of 5 mink mortalities are tested, this sampling scheme provides 95% confidence in detecting at least 1 infected mink when there is a 50% SARS-CoV-2 infection prevalence amongst the dead. Higher mink mortality numbers and testing can detect a lower infection prevalence among the dead mink (Cannon, 2001. Sense and Sensitivity.)
- The actual type and number of specimens to be collected should be determined in collaboration with the testing laboratory and state animal health authority. Sample pooling may be considered if the laboratory and animal health authorities concur it is appropriate, with a minimum of 2 pooled samples to statistically meet 95% confidence in detections. An off-site pelting facility should only accept animals from an infected farm with permission from the state animal health authority.
- Off-site pelting facilities planning to accept animals from known positive farms must have adequate safeguards in place to protect their workers and to prevent the dissemination of SARS-CoV-2 virus from asymptomatic animals to neighboring farms and other farms served by the pelting facility.

Appendix: Worker Safety and Monitoring

CDC has a Coronavirus Self-Checker available online to help people make decisions on when to seek testing and appropriate medical care.

Self-screening: Farmers and farm workers, and family members of people who work on farms should self-screen for COVID-19, a relatively simple and inexpensive way to protect people and animals on the farm. People who work on the farm should do this each time before they come to the farm.

People should not attempt to enter the farm if they have any of the following:

- Symptoms of COVID-19
- Temperature equal to or higher than 100.4°F*
- Are under evaluation for COVID-19 (for example, waiting for the results of a SARS-CoV-2 test)
- Have been diagnosed with COVID-19 and not yet cleared to discontinue isolation

Screening and health checks are not a replacement for other protective measures such as social distancing, hand hygiene, and wearing a mask. Other prevention measures to protect people from COVID-19 should be followed as well.

Regular Monitoring: If the employee doesn't have a fever or symptoms, they should self-monitor under the supervision of their employer's occupational health program.

Wear a Mask: The employee should wear a mask at all times while in the workplace for 14 days after last exposure. Employers can issue masks or can approve employee-supplied masks in the event of shortages. Ensure that masks are always worn properly by following information at this site: https://www.cdc.gov/coronavirus/2019-ncov/prevent-getting-sick/diy-cloth-face-coverings.html

Social Distance: The employee should maintain 6 feet and practice social distancing as work duties permit in the workplace.

Hand hygiene: Perform frequent hand hygiene using soap and water for at least 20 seconds. In addition, to increasing the frequency of hand washing, if hands aren't visibly soiled or dirty, workers can use hand sanitizer containing at least 60% alcohol, rubbing hands until they are dry. Ensure that access to handwashing and/or hand sanitizing is readily available.

Disinfect and Clean work spaces: Clean and disinfect all areas such as offices, bathrooms, common areas, shared electronic equipment at least daily. Clean and disinfect shared tools, equipment, and vehicles between employee use, if possible. Conduct targeted and more frequent cleaning and disinfecting of high-touch areas of shared spaces such as time clocks, bathroom fixtures, and door handles.

Return to work: If a farmer or farm worker develops a fever or symptoms of COVID-19 or is diagnosed with COVID-19, they should isolate and only return to work or enter the farm when it is safe to do so. For a farmer or farm worker with symptoms of COVID-19, they should not return to work for at least 10 days since symptoms first appeared, at least 24 hours with no fever, and symptoms have improved. For a farmer or farm worker who tested positive but had no symptoms, they should not return to work for 10 days since the date of the positive test.

Acronyms Used in Interim Guidance and Linked Websites:

APHIS: Animal and Plant Health Inspection Service

AVIC: Area Veterinarian in Charge

BHI: Brain-Heart Infusion broth

CDC: Centers for Control and Prevention

FAQ: Frequently Asked Question

IP: infected premises

NAHLN: National Animal Health Laboratory Network

NIOSH: National Institute for Occupational Health and Safety

NVSL: National Veterinary Services Laboratories

OSHA: Occupational Safety and Health Administration

PPE: Personal Protective Equipment

RT-PCR: reverse transcription polymerase chain reaction

SAHO: State Animal Health Official

SPHV: State Public Health Veterinarian

VS: Veterinary Services

VTM: Viral Transport Media

USDA: United States Department of Agriculture

Acknowledgements:

Chair: Dr. David Smith, Director, Division of Animal Industry, NYS Department of Agriculture and Markets.

Members of the One Health Federal Interagency COVID-19 Coordination Group, Livestock subgroup.

USDA-APHIS-VS, CDC, Wisconsin Department of Agriculture, Trade and Consumer Protection and USA Fur Commission subject matter experts.

Reference Materials

Interim SARS-CoV-2 Guidance and Recommendations for Farmed Mink and Other Mustelids: https://www.aphis.usda.gov/animal_health/one_health/downloads/sars-cov-2-guidance-for-farmed-mink.pdf

CDC COVID-19 and Animals: https://www.cdc.gov/coronavirus/2019-ncov/daily-life-coping/animals.html

CDC COVID-19 and Animals Frequently Asked Questions: https://www.cdc.gov/coronavirus/2019-ncov/faq.html#Pets-and-Animals

CDC Evaluation for SARS-CoV-2 Testing in Animals: https://www.cdc.gov/coronavirus/2019-ncov/animals/animal-testing.html?CDC_AA_refVal=https%3A%2F%2Fwww.cdc.gov%2Fcoronavirus%2F2019-ncov%2Fphp%2Fanimal-testing.html

CDC COVID 19 Symptoms: https://www.cdc.gov/coronavirus/2019-ncov/symptoms-testing/symptoms.html

Guidance on Preparing Workplaces for COVID-19: https://www.osha.gov/Publications/OSHA3990.pdf

CDC/DOL Interim Guidance for Agriculture Workers and Employers https://www.cdc.gov/coronavirus/2019-ncov/community/guidance-agricultural-workers.htmlUSDA FAQ for State Animal and Public Health Officials on Animal Coronavirus Testing: https://www.aphis.usda.gov/animal_health/one_health/downloads/faq-public-on-companion-animal-testing.pdf

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FDA SARS-CoV-2 Necropsy Resources: https://www.fda.gov/animal-veterinary/science-research/vet-lirn-sars-cov-2-supplemental-necropsy-sample-inventory-checklist

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Version 1, 7 May 2020

WORLD ORGANISATION FOR ANIMAL HEALTH
Protecting animals, preserving our future

Considerations for sampling, testing, and reporting of SARS-CoV-2 in animals

Prepared by the OIE Preparedness and Resilience Department and the OIE *ad hoc* Group on COVID-19 and the human-animal interface

COVID-19, caused by infection with SARS-CoV-2, is a human disease which most likely emerged from an animal source and through widespread human to human transmission became a pandemic. COVID-19 is a reminder of the critical importance of the One Health approach. The nature of this new zoonotic virus, its widespread distribution, and the susceptibility of some animal species to infection means that close contact between people and animals may result in animal infections. The results of laboratory and epidemiological field investigations may provide evidence to better assess the implications of widespread human SARS-CoV-2 infections for animal health and welfare, veterinary public health, and wildlife conservation. This information can support a range of risk mitigation measures. However, the decision to carry out animal sampling should have a strong rationale and consider the broader public health response to COVID-19, including the availability of resources for human sampling and public health measures in place to limit disease spread.

Further information on current knowledge about SARS-CoV-2 in animals can be found on the OIE website: https://www.oie.int/scientific-expertise/specific-information-and-recommendations/questions-and-answers-on-2019novel-coronavirus/

Further information on the public health aspects of COVID-19 can be found on the WHO website: https://www.who.int/emergencies/diseases/novel-coronavirus-2019

Purpose

The purpose of this document is to provide high level considerations on sampling, testing, and reporting of SARS-CoV-2 in animals.

Scope

The following considerations are intended to be non-prescriptive and broad enough to cover a range of human and animal interactions. The document aims to differentiate individual case management from research.

This document will be reviewed and updated as new scientific evidence of SARS-CoV-2 infection in animals comes to light.

1. SARS-CoV-2 as an emerging disease in animals

Collaboration and coordination across all relevant sectors and disciplines, using a One Health approach, is required to address zoonotic diseases and other shared health threats at the human-animal-environment interface. This involves a broad range of actors including the Veterinary Services, public health services, wildlife agencies, ecology organisations, and the private sector.

To assess and mitigate risks of an emerging disease at the human-animal-environment interface, under certain circumstances it may be appropriate to sample and test animals for SARS-CoV-2. However, the decision to sample and test animals must carefully consider the benefits and scientific rationale e.g. what knowledge will be gained and what action can be taken, against potential negative consequences such as impacts on animal health and welfare and public health. In some situations, there may be competition for valuable resources needed for the public health response. The decision to sample must consider (and support) the broader national public health strategy for COVID-19 which will vary between countries.

2. High level guiding principles for sampling and testing

Based on current evidence, widespread testing of animals for SARS-CoV-2 is not recommended. Joint risk assessment carried out by public health and Veterinary Authorities (perhaps, in some cases involving wildlife experts) may guide the decision on whether to sample and test animals under certain defined circumstances. Sampling and testing of animals could be considered in situations where the results will inform decision making, animal case or population management, or public health response, or further the body of knowledge on the transmission of the virus. Guidance already exists on measures to take when animals have close contact with humans suspected or confirmed to be infected with SARS-CoV-2 (see OIE COVID-19 Q and A).

Any sampling and testing of animals must consider the broader response to COVID-19 and be coordinated with public health services. The decision should also consider the potential need to prioritise the availability of valuable resources (such as personal protective equipment (PPE), laboratory staff, diagnostic reagents) for public health services. Information about animal infections should complement, rather than distract attention from or confuse, the important public health risk communication messages. Communication of test results should avoid inappropriate measures being taken against domestic or wild animals which might compromise their welfare or health or have a negative impact on international trade or biodiversity, if misinterpreted.

Consideration should be given to the public health implications associated with handling and sampling of potential positive animals as it puts people at risk and requires appropriate PPE. This could include risks from moving animals (by owners) from their household or temporary shelter for testing, or for veterinarians being exposed to humans infected with COVID-19 during sampling in either the clinic, household setting, or other setting.

Sampling should be done by competent personnel trained in the correct use of PPE, and chain of custody of samples should be maintained. Depending on the type of test, samples may include single or combinations of oropharyngeal, nasal, and rectal swabs, and blood. When collecting and taking samples, care should be taken to avoid cross-contamination from the environment or from infected humans.

The laboratory should use a validated test, appropriate to the purpose of testing, which is important when testing across different species due to potential variation in sensitivity and specificity. If a private laboratory tests animal samples, close communication and coordination should be maintained with the Veterinary Authority. If real-time RT-PCR is used for detection and borderline PCR cycle threshold (Ct) values are obtained, further validation and confirmatory testing may be required.

The actions to be taken on positive or negative findings should be carefully planned for before sampling and testing of animals for SARS-CoV-2.

3. Rationale for testing of animals to manage risk

Sampling and testing of animals should not be conducted without a clear rationale. The rationale should consider the risk of infection of animals, the risk of exposure to other susceptible animals or humans, and the consequences of exposure. Animal testing strategies should be coordinated with the public health response and consider the need to prioritise resources (including reagents, laboratory capacity, technical personnel, PPE etc.) for the overall response to COVID-19.

The table below has been adapted from a version initially developed collaboratively by the Centers for Disease Control and Prevention and the US Department of Agriculture, USA[1]. It provides epidemiological risk factors and clinical features that can guide decisions on the testing of animals for the purpose of case management.

Epidemiological Factors		Clinical Features
Animal with history of close contact with a person suspected or confirmed to be infected with SARS-CoV-2	AND	Animal has clinical signs* suspicious of SARS-CoV-2 infection.
Animal with exposure to a known high-risk environment (i.e., where human cases have occurred), such as a residence, facility, or vessel (e.g. nursing home, prison, cruise ship).		
Threatened, endangered or otherwise animal of high conservation value in a rehabilitation, captive breeding or zoological facility when there is suspicion of contact with a SARS-CoV-2 infected person or animal.	AND	Animal is asymptomatic; OR Animal has clinical signs* suspicious of SARS-CoV-2 infection
Animals in a mass care or group setting (e.g., animal shelter, boarding facility, animal feeding operation, zoo) including companion animals, livestock, and other species, where their exposure history to people with SARS-CoV-2 infection is unknown.	AND	A single case, or cluster of animals show clinical signs* suspicious of SARS-CoV-2 infection.

* For more information on clinical signs see section 4. Some animals have been infected with SARS-CoV-2 without showing clinical signs. Therefore, there may be instances when asymptomatic animal(s) may be tested based on veterinary clinical and/or public health judgement.

The following are examples of general considerations for sampling and testing different categories of animals in the context of risk management:

- **Companion animals**
  - The likelihood of human to animal transmission through close contact between humans (e.g. owners, general public, workers, visitors etc.) and animals
  - Potential frequency and number of animal contacts with humans (e.g. for working or service animals) and other animals
  - Susceptibility of different animal species to infection
  - The likelihood of companion animals spreading infection to other households through contact with other companion animals or directly with humans in other households
  - The likelihood of companion animals spreading infection to other contact animals (e.g. gatherings, colonies, stray animals, free ranging)
  - The likelihood of spread through trade and movement

[1] https://www.cdc.gov/coronavirus/2019-ncov/php/animal-testing.html

- Potential consequences of exposure (human infection and illness; vulnerable individuals or groups; disease spread; establishment of animal reservoirs; high risk settings)

- **Livestock**
  - The likelihood of human to animal transmission through close contact between humans (e.g. workers, visitors etc.) and groups of animals
  - Susceptibility of different animal species to infection
  - The likelihood of virus amplification in susceptible species (close contact between animals and size of groups)
  - The likelihood of spread through trade and movement
  - Potential consequences of exposure (human infection and illness; animal infection and illness; animal production; disease spread; economic; establishment of animal reservoirs)

- **Wildlife**
  - The likelihood of human to wild animal transmission through contact between humans (e.g. researchers, conservationists, volunteers, public) and wildlife species
  - Susceptibility of different wild animal species to infection
  - The likelihood of infection of other wildlife following release of captive wild animals to the field
  - Translocation of wildlife from one location to another
  - The likelihood of infection of high value endangered species
  - Potential consequences of exposure (human infection and illness; wildlife mortality and risk to conservation efforts/biodiversity; disease spread; establishment of new wildlife reservoirs)

- **Zoos (or zoological collections)**
  - The likelihood of human to animal transmission through contact between humans (e.g. workers, public) and captive animals in a zoo or zoological collection
  - Susceptibility of different animal species to infection
  - The likelihood of infection of high value endangered species
  - The likelihood of moving infection between zoos or zoological collections
  - Consequences of exposure (human infection and illness; disease spread; risk to conservation/biodiversity; economic)

- **Animal gatherings and group animal settings**
  - The likelihood of human to animal transmission through contact between humans (e.g. workers, general public, owners) and animals
  - Potential frequency and number of contacts with humans and other animals
  - Susceptibility of different animal species to infection
  - The likelihood of introducing infection to gathered animals
  - The likelihood of animal to animal transmission at the gathering (e.g. temporary, permanent, resident animals or visitor animals)
  - The likelihood of further spreading infection through dissemination of contact animals
  - Consequences of exposure (human infection and illness; disease spread; amplification of infection; risk to animal health; establishment of reservoirs)

4. Suggested Case definition

- SARS-CoV-2 Clinical Signs in animals:

To date there is limited knowledge about the susceptibility of different animal species. However, current evidence suggests clinical signs may include but are not limited to; nasal discharge, respiratory distress, coughing, vomiting or gastrointestinal disease. As in humans, mild or asymptomatic infections are likely to occur and should be considered in epidemiological investigations.

- Case definitions (may evolve with increasing information):

The following are suggested case definitions that can be adapted to local contexts.

Suspected case:

- SARS-CoV-2 infection can be suspected in an animal if;
  - Animal has clinical signs suggestive of SARS-CoV-2 infection (described above) and all other likely differential diagnostic aetiologies have been effectively ruled out by a veterinarian.

    AND

  - Animal has an epidemiological link with a confirmed human COVID-19 patient, SARS-CoV-2 infected animal or suggestive case history indicating potential exposure.

Confirmed case

The following defines a laboratory confirmed case of SARS-CoV-2 infection in an animal (with or without clinical signs):

- SARS-CoV-2 has been isolated from a sample* taken directly from an animal;

OR

- Viral nucleic acid has been identified in a sample* taken directly from an animal, giving cause for suspicion of previous association or contact with SARS-CoV-2, by:
  a) Targeting at least two specific genomic regions at a level indicating presence of infectious virus; OR
  b) Targeting a single genomic region followed by sequencing of a secondary target.

* Samples for virus isolation and viral nucleic acid are preferably nasal swab, oropharyngeal swab, nasal washing, tracheal swab and/or a rectal sample may be taken, or a faecal sample may be used in situations where direct sampling is not possible due to risks to the animal or testing staff; or from internal organs collected post-mortem.

5. Reporting to the OIE

In accordance with Chapter 1.1. of the *Terrestrial Animal Health Code*, confirmed cases should be notified as an emerging disease to the OIE through the World Animal Health Information System (WAHIS). As per Article 1.1.6 of the *Terrestrial Animal Health Code*, Member Countries are encouraged to report any other relevant information, such as experimental studies or prevalence surveys, to the OIE World Animal Health Information and Analysis Department as a summary report to information.dept@oie.int. In the context of early warning, Member Countries should send these reports in a timely manner.

The purpose of collecting and sharing this information at international level is to better understand SARS-CoV-2 epidemiology with a view to informing risk management and risk communication under a One Health approach.

The WAHIS system uses a standardised template. However, in order to capture the additional information which is critical to our understanding of emerging diseases, Countries are also encouraged to fill in the free text boxes available, giving particular consideration to the i) Zoonotic potential, ii) Description of the population affected by the outbreak[2], iii) Source of the outbreak or origin of infection, and iv) Epidemiological comments about the event. Particular attention should be given to providing information on the "Description of the population affected" that should focus on additional data at the outbreak level (i.e. clinical signs of the animals), and on the "Epidemiological comments" that should provide information at the event level (an "event" includes all epidemiologically related outbreaks (i.e. animal population survey, sampling information).

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[2] As per definition of the *Terrestrial* and *Aquatic Animal Health Code*, an outbreak is defined as "the occurrence of one or more cases in an epidemiological unit."

SARS-CoV-2 and the Role of Orofecal Transmission: Evidence Brief

Jefferson T, Spencer EA, Brassey J, Heneghan C.
In: Analysis of the Transmission Dynamics of COVID-19: An Open Evidence Review.
Published Online July 17, 2020.

http://www.cebm.net/evidence-synthesis/transmission-dynamics-of-covid-19/

Verdict

Various observational and mechanistic evidence presented throughout this evidence brief, support the hypothesis that SARS-CoV-2 can infect and be shed from the human gastrointestinal tract.

Policy

Policy should emphasise routine surveillance of food, wastewaters and effluent. The importance of strict personal hygiene measures, chlorine-based disinfection of surfaces in locations with presumed or known SARS CoV-2 activity should form part of public policy and education campaigns. Stool testing should be carried out in dischargees from the hospital or other holding facilities well before discharge date and discharge should be conditional either on cessation of fecal excretion or strict quarantine and personal hygiene measures in those still excreting viral particles by stool independently from respiratory excretion.

Further research

Each outbreak should be investigated and a report be made publicly available rapidly. Testing of stools should be carried out in all people involved in the outbreak.

As there is coherent evidence of ingestion, penetration of enterocytes and excretion of live SARs CoV-2 in possible analogy with SARs and MERS agents we believe this working hypothesis should be tested by conducting case-control studies during the investigation of outbreaks following a set protocol.

Cases would be cases of COVID-19 (with a subset by symptom presence and severity) either fecally excreting virions or not (cases and contacts) and controls would be healthy matches.

Exposure to potentially fecally contaminated materials and protective measures taken would be elicited at interview. To minimise the play of recall and ascertainment bias, interviewers should be blind to fecal excretion status and the interview should take place as soon as possible after the event.

Viability of fecal isolates and their possible pathogenicity should be tested in outbreaks, irrespective of the presence of symptoms or nasal swab positivity.

Background

Understanding how, when and in what types of settings SARS-CoV-2 spreads between people is critical to developing effective public health and infection prevention measures to break chains of transmission.[1]

Current evidence suggests SARS-CoV-2 is primarily transmitted via respiratory droplets and contact routes and can occur between pre-symptomatic or symptomatic infected individuals to others in close contact.

SARS-CoV-2 has been shown to contaminate and survive on certain surfaces, but currently, no reports have directly demonstrated fomite to human transmission. SARS-CoV-2 has also been detected in the feces of some patients which taken together with fomite transmission suggest the possibility that SARS-CoV-2 could transmit via the orofecal route.

Orofecal describes a route of transmission where the virus in fecal particles can pass from one person to the mouth of another. Main causes include lack of adequate sanitation and poor hygiene practices. Fecal contamination of food is another form of orofecal transmission.

Other single-stranded RNA viruses such as noroviruses are transmitted primarily through the orofecal route, either by consumption of contaminated food or water or from direct person to person to person spread.

Methods

We are undertaking an open evidence review investigating factors and circumstances that impact on the transmission of SARS-CoV-2, based on our published protocol. In brief, this review aims to identify and evaluate relevant articles (peer-reviewed or awaiting peer review) that examine the mode of viral transmission and ecological variables influencing the mode of transmission. Studies with modelling are only included if they report transmission outcome data, not predicted outcomes. We assess study quality based on five criteria and report important findings on an ongoing basis. When necessary we wrote to several authors of included studies for further details or clarification on the content of their articles.

Evidence update

In this first version we have summarized 36 studies examining the potential role of orofecal transmission of SARS-CoV-2 (see Table), and included mechanistic and observational evidence from a further 22 studies (see References). Overall the evidence is low to moderate quality (see the quality of included studies). We provide a narrative summary of the evidence through a link at the end of each title in the left-hand column. The original paper is accessible from our summaries.

SARS-COV-2 excretion and detection via the orofecal route

A review of 29 relevant studies (23 published and 6 preprints) reported that approximately 12% of patients with SARS-CoV-2 infection reported gastrointestinal symptoms, including diarrhoea, nausea, and vomiting. Eight included studies reported the detection of viral RNA of SARS-CoV-2 in stool and the pooled analysis reported that RNA shedding in stool was detected in up to 41% of COVID-19 patients [Parasa 2020].

In a group of 206 hospitalised patients with mild COVID-19, digestive symptoms were present in over half: 48 presented with a digestive symptom alone, 69 with both digestive and respiratory symptoms. [Han C 2020] Patients with digestive symptoms had a longer duration between symptom onset and viral clearance and were more likely to be fecal virus-positive (73% vs 14%, P=0.033) than those with respiratory symptoms. A further review of fourteen small studies that vary from 153 cases to a single case report reported that SARS-CoV-2 may be transmitted oro-fecally [Amirian 2020]

- Table 1. Parasa 2020. Characteristics of the Included Studies
- Table 2. Amirian 2020. Characteristics of the Included Studies

A second review of observational and mechanistic evidence provides further support that SARS-CoV-2 can infect and be shed from the human gastrointestinal tract. [Ding S 2020]

A review of 26 studies reported that there is a high rate of PCR positive persistence of SARS-CoV-2 in fecal samples of patients with COVID-19. [Gupta 2020] The review included 824 patients across the studies and 540 tested for fecal viral RNA: 291 (54%) had positive fecal RT-PCR tests. None of the studies was designed to detect live fecal virus except for the study by [Wang 2020].

Tian 2020 reviewed 15 included studies with data from 2,023 patients (mainly from China) and showed that gastrointestinal symptoms are common in COVID-19 patients and were observed with increased prevalence as the epidemic progressed in China.

Timing of fecal shedding

A retrospective study of 133 hospitalised COVID-19 patients identified 22 whose sputum or fecal samples tested positive, after their pharyngeal swabs became negative. [Chen 2020] This study assessed the results of real-time quantitative fluorescence polymerase chain reaction (RT-qPCR) for SARS–CoV2 RNA of sputum and fecal samples from a group of hospitalised COVID-19 patients, after conversion of their pharyngeal samples from positive to negative.

A convenience sample was retrospectively identified, of patients admitted to Beijing Ditan Hospital, Capital Medical University, with a diagnosis of COVID-19 and paired RT-qPCR testing of pharyngeal swabs with either sputum or feces samples. Among 133 patients admitted with COVID-19 from 20 January to 27 February 2020, 22 patients (4 of whom were children) with an initial or follow-up positive sputum or fecal samples paired with a follow-up negative pharyngeal sample were identified. From these 22 patients, 545 samples were available, including 209 pharyngeal swabs, 262 sputum samples, and 74 feces samples. Chen 2020 does not report on the viability of the viral fecal samples.

Cheung 2020 reported in a cohort of 59 patients in Hong Kong with COVID-19 that fecal discharge continues long after respiratory shedding of COVID-19 has ceased. Gupta 2020 reported that the duration for fecal shedding of viral RNA after clearance of respiratory samples ranged from 1 to 33 days and in one patient up to 47 days from symptom onset.

In the review by Tian 2020 fecal PCR testing was shown to be as accurate as respiratory specimen PCR detection, and fecal excretion persisted after sputum excretion in 23% patients for 1 to 11 days. A systematic review of four case series including 36 children with mild COVID-19 found that fecal shedding occurs on average nine days longer than by the respiratory route. Three times as many children had SARS-CoV-2 shedding in stools after 14 days of symptoms onset compared to respiratory samples, RR= 3.2 (95%CI 1.2 to 8.9). Because of the delayed fecal shedding. [Santos 2020] The review authors were unsure whether the fecally shed viruses were viable and hence infectious.

A short review by Donà 2020 including six studies of children reports the orofecal route is an alternative route of transmission, regardless of presenting COVID-19 symptomatology. Citing evidence from the SARS-CoV-1 outbreak that fecal excretion could be ongoing even after 30 days from symptom onset, the review authors recommend that exclusion of SARS-CoV-2 infection by single time point nasopharyngeal swabs should not be used in children.

- Table 3. Santos 2020. References of the Included Studies
- Table 4. Donà 2020. References of the Included Studies

Live SARS-COV-2 excretion by the fecal route

Many studies have identified SARS-CoV-2 RNA in fecal samples. Most studies have been unable to identify live viruses within fecal samples. Three case studies (Wang W 2020, Xiao 2020b and Yong Z 2020) report isolating the virus (in 2 patients, 1 patient and 1 patient respectively).

Wang 2020 detected SARS-CoV-2 in the feces of 44 of 153 (29%) specimens collected from 205 patients with COVID-19 from three hospitals in the Hubei and Shandong provinces and Beijing. RNA was extracted by RT-PCR targeting the open reading frame 1ab gene of SARS-CoV-2. A cycle threshold value less than 40 was interpreted as positive for SARS-CoV-2 RNA. Four positive fecal specimens with high copy numbers were then cultured, and electron microscopy performed to detect live virus. Live SARS-CoV-2 virus was observed in the stool sample of two patients who did not have diarrhea. The Parasa 2020 review interpreted this as evidence that the gastrointestinal tract supports the growth of SARS-CoV-2 to an extent similar to previous SARS infections, and it might explain some of the rapid spread of disease.

Xiao 2020b Identified by Susan Amirian undertook a case-series of 28 hospitalised patients with severe COVID-19. for whom feces samples were available.

Among the specimens collected 12 were positive for viral RNA at least one-time point. SARS-CoV-2 virus was successfully isolated from two of the viral RNA–positive patients. Viral particles that were visible were spherical and had distinct surface spike protein projections, consistent with a previously published SARS-CoV2 image. Four serial feces

samples from a seriously ill 78-year old patient with COVID-19 all tested positive for viral RNA; the patient subsequently died. Viral antigen was also detected in gastrointestinal epithelial cells of a biopsy sample, from this 78-year old COVID-19 patient.

Yong Z 2020 isolated live virus from the stools of one severe pneumonia case, pointing to a possible orofecal spread. There were unclear and sparse clinical details in the study report.

A preprint Identified by Susan Amirian on the patient-derived mutations impact pathogenicity of SARS-CoV-2 seems to indicate that 3/3 stools contained live virus (see pdf p 24) [2] and is capable of replicating in stool samples.

Tian 2020 review (mainly based on Chinese data) reported that angiotensin-converting enzyme 2 (ACE2) and virus nucleocapsid protein were detected in gastrointestinal epithelial cells, and infectious virus particles were isolated from feces. A case series of 28 hospitalised patients for whom feces samples were collected reported that SARS-CoV-2 virus was successfully isolated from two of the viral RNA–positive patients. Viral particles that were visible were spherical and had distinct surface spike protein projections, consistent with a previously published SARS-CoV-2 image. [Xiao F 2020 b] Four serial feces samples from a seriously ill 78-year old patient with COVID-19 all tested positive for viral RNA; the patient subsequently died. Viral antigen was also detected in gastrointestinal epithelial cells of a biopsy sample, from this 78-year old COVID-19 patient.

Zang R 2020 undertook a laboratory study that reported that human enterocytes express high ACE2 receptor levels, which could support infection with SARS-CoV-2. However, they reported the virus is rapidly inactivated in the GI tract. This poses the question of how enveloped coronaviruses could survive the low pH of the stomach and the effect of bile salts in the small bowel.

An assessment of viral RNA in feces from 71 hospitalized patients with SARS-CoV-2 reported that viral RNA and viral nucleocapsid protein in gastrointestinal tissues was extracted from one patient. [Xiao F 2020] From the 1st to 14th February 2020, clinical specimens, including serum, nasopharyngeal, and oropharyngeal swabs; urine; stool; and tissues were obtained from 73 hospitalized patients infected with SARS-CoV-2 were obtained and tested for SARS-CoV-2 RNA. Immunofluorescent data showed that ACE2 protein (a cell receptor for SARS-CoV-2) is expressed in the glandular cells of gastric, duodenal, and rectal epithelia, supporting the entry into the host cells. SARS-CoV-2 might therefore both infect the gastrointestinal system and transmit via the orofecal route, and detection of viral nucleocapsid protein in rectal epithelial cells suggests that some infectious viral particles can survive the adverse gastrointestinal environment.

Ding S 2020 review cited evidence that SARS-CoV-2 can survive the adverse conditions in the gastrointestinal system. Both the S glycoproteins and the viral envelope must resist degradation to infect enterocytes. Heavy glycosylation of the large spike S protein has been shown to lead to resistance to the proteases, the low pH and bile salts found in the gastrointestinal system. Some gastric processes may actually facilitate viral entry into the enterocytes: in bovine coronavirus, one specific site on the S glycoprotein has to be cleaved by an intracellular protease or trypsin to activate viral infectivity and cell fusion.[3]

Cruise Ships

Evidence of fomite transmission of COVID-19 first emerged due to quarantine on the Diamond Princess Cruise Ship. The infection rate onboard was high and clinical harm was considerable onboard the ship. [Yamahata Y] Of those tested, 696 (19%) tested positive for COVID-19, of which 410 (59%) were asymptomatic. The structure of the cruise ship made it difficult to carry out the medical services required for an outbreak of an emerging infectious disease. The authors noted that one of the elevator halls may have been a transmission point because it was impossible for infected and non-infected people to use the elevator separately. Since all passengers were isolated in each cabin, supplies had to be delivered daily to each room. The disposal of the sewage was also a challenge and eventually, a service tender came to extract sewage from the ship. Fifteen of the 20 confirmed cases occurred in crew members among the food service workers, and sixteen cases occurred among those with cabins on deck 3, the deck on which the food service workers lived. [Kakimoto 2020]

Choir Practice

The high SARS-CoV-2 attack rate following exposure at a choir practice in Skagit County, Washington suggested that transmission of COVID-19 was facilitated by close proximity and physical contact and may have been augmented by the act of singing. [Hamner L 2020]. The 2.5-hour singing practice, however, also provided opportunities for orofecal transmission, as members shared snacks at the end of the practice.

Acute Healthcare Settings

An investigation of SARS-CoV-2 on surfaces and air contamination in an acute healthcare setting in London found that many hospital surfaces and air samples contained viral RNA. [Zhou J] Viral RNA was detected on 114/218 (52%) of surfaces and 14/31 (30%) air samples. The proportion of surface samples contaminated with viral RNA varied by item sampled and by clinical area. And although viral RNA was more likely to be found in areas immediately occupied by COVID-19 patients than in other areas, 45% of the samples were from areas not immediately occupied by a COVID-19 patient. Surface contamination was detected on a range of items: computer keyboards, chairs, and alcohol dispensers had the highest proportion of samples. Viable virus, however, was not cultured from any of the air or surface samples.

An analysis of 626 surface swabs within the Zhongnan Medical Center in Wuhan between 7th February and 27th February 2020 found 14% of the 626 surface samples were positive for viral RNA. One third (32%) of the contaminated zones were found in the intensive care unit, 28% were in the obstetric ward specialized for pregnant women with COVID-19 and 20% were in the ward for COVID-19 patients. The most contaminated surfaces were self-service printers (20%), desktop/keyboard (17%), and door handles (16%). Hand sanitizer dispensers (20%) and gloves (15%) were the most contaminated protective equipment.[4]

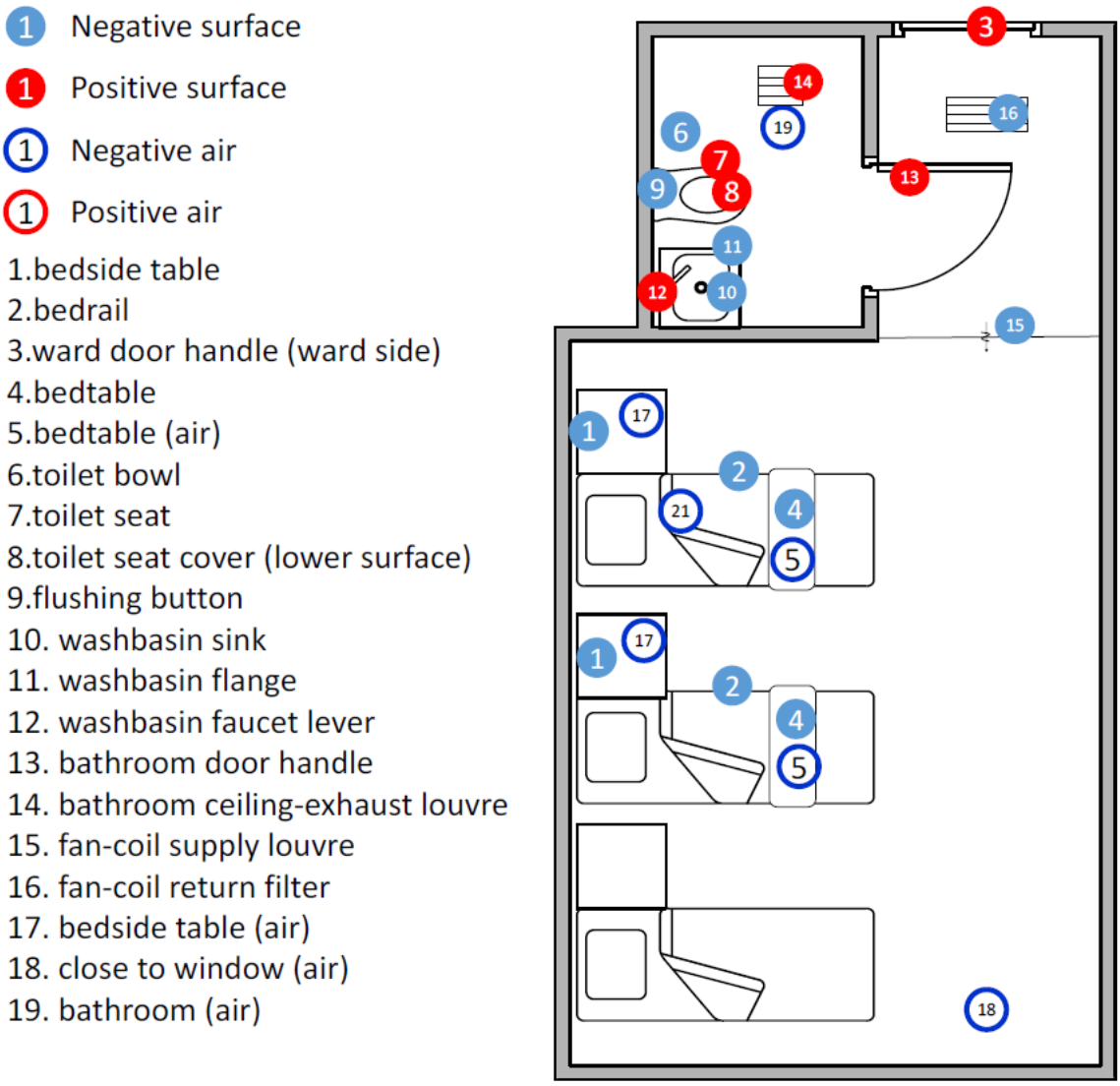
From January 24th to February 4th, three infected patients in airborne infection isolation rooms with anterooms and bathrooms had surface environmental samples taken at 26 sites. In two symptomatic patients rooms, after routine cleaning all samples were negative. In

the third patient's room, samples were collected before routine cleaning and were found to be positive for 13 out of 15 (87%) sites (including air outlet fans) and 3 of 5 toilet sites (toilet bowl, sink, and door handle) positive. Patient C had upper respiratory tract involvement and two positive stool samples for SARS-CoV-2 on RT-PCR despite not having diarrhoea. [5]

A study in February 2020 the infectious diseases hospital Nanjing, China randomly sampled the 3-bed isolation rooms of the COVID-19 designated infectious diseases hospital, Nanjing, China. [Ding Z 2020] Environmental sampling was also carried out in four isolation rooms, a nursing station, a corridor, an air-conditioning system and other spaces in the airborne infectious-disease zone on the fifth floor of the hospital. Sampling procedures are described accurately and the air sampler twice needed to be quarantined despite wearing full PPE. Airflow was also assessed between 4th and 5th floors in the building using a smoke tracer.

Of 107 surface samples (37 from toilets, 34 from other surfaces in isolation rooms and 36 from other surfaces outside isolation rooms). Four samples were positive (2 two ward door door-handles, one bathroom toilet toilet-seat cover and one bathroom door door-handle). Three were weakly positive from a bathroom toilet seat, one bathroom washbasin tap lever and one bathroom ceiling exhaust louvre. One of the 46 corridor air samples was weakly positive.

The paper has a very clear colour-coded figure showing the timeline of onset and hospitalisation dates and the sampling dates of the events in the isolation rooms containing beds 2 and 3, beds 16-18, beds 31 and 32, and bed 55, and their 10 patients. The sampling dates on which positive samples were detected are also shown by a red tick. In each room, a patient and his/her bed are shown in the same colour.



The figure shows a summary of the location of the samples taken in the isolation rooms. Reproduced from Ding Z, Qian H, Xu B, Huang Y, Miao T, Yen H-L, et al. Toilets dominate environmental detection of SARS-CoV-2 virus in a hospital. medRxiv 2020.04.03.20052175 2020

To determine the distribution of SAR-S-CoV-2 in hospital wards in Wuhan, China, Guo ZD[6] tested air and surface samples. The virus was widely found on floors, computer mice, trash cans, and sickbed handrails. The nucleic acid test used did not indicate the amount of viable virus. The virus was also widely distributed in the air and patient masks also contained infected exhaled droplets and oral secretions. The authors recommended adequately disinfecting such masks before discarding them.

A study in the First Affiliated Hospital of Zhejiang University, China found that strict disinfection and hand hygiene could decrease the hospital-associated COVID-19 infection risk of the staff in isolation wards. The study monitored the presence of SARS-Cov-2 among

hospital environment surfaces, sewage, and personal protective equipment (PPE) of staff in isolation wards in the First Affiliated Hospital of Zhejiang University, China. During the study period, 33 patients were hospitalized in isolation wards, and no SARS-Cov-2 RNA was detected among the 36 objects surface samples and nine staff PPE samples in isolation wards. [7]

Surfaces of objects were wiped with 1000 mg/L chlorine-containing disinfectant every 4 hours in the isolation ICU ward and every 8 hours in general isolation wards. Preprocessing disinfection equipment was added before sewage drainage from the isolation wards into the final sewage disinfection pool. The sewage samples from the inlet pool were found to be positive, and from the outlet of the preprocessing pool weakly positive, but the sewage sample from the last disinfection pool was found to be negative. No viable virus was detected by culture.

Sewage

Concentration and detection of SARS coronavirus was found in sewage concentrates in China in two hospitals receiving SARS patients prior to disinfection, and occasionally after disinfection. There was no live SARS-CoV detected in the sewage in these assays. In this study, the authors found that the virus can survive for 14 days in sewage at 4°C, 2 days at 20°C, and its RNA could be detected for eight days although the virus had been inactivated. [Wang XV 2020]

Sentinel surveillance of SARS-CoV-2 in wastewater has been shown to anticipate the occurrence of COVID-19 cases. SARS-CoV-2 was detected in sewage 41 days before the declaration of the first COVID-19 case in Spain and in frozen samples dating back to 12 March 2019. If this is confirmed, the results suggest SARS CoV-2 has been around longer than first thought. [Chavarria-Miró G 2020]

Even at low COVID-19 prevalence, sewage surveillance could be a sensitive tool to monitor the viral circulation. SARS-CoV-2 RNA detection occurred in volumes of 250 mL of wastewaters collected in both areas at high (Milan) and low (Rome) epidemic circulation, according to clinical data. Six out of 12 samples were positive. [La Rosa G 2020] One of the positive results was obtained in a Milan wastewater sample collected three days after the first notified Italian case of autochthonous SARS-CoV-2 at Codogno. A second positive sample was taken on the 28th of February in Milan when COVID-19 cases were only 29.

Environmental screening may, therefore, be a very sensitive tool to gauge viral presence before clinical symptoms become apparent. SARS-CoV-2 was detected in the sewage of five sites a week after the first COVID-19 case in the Netherlands. The identification of viral antigens in sewage samples occurred when the observed COVID-19 prevalence was around or even below 1.0 case per 100,000 people. Stronger signals were observed when the prevalence was 3.5 cases per 100,000 people or more. [Medema G 2020] The authors did point out that none of the isolates are likely to be viable and the testing method needs refining.

A systematic review of what is known of the presence and survival of coronaviridae in various water settings included twelve articles. [La Rosa 2020] The authors remarked on the poor evidence base for enveloped viruses and that the methods of concentration and collection for these viridae may not be appropriate. Coroviridae have been isolated in different types of liquids from waste to surface water but in general, they appear to be unstable. Chlorination and higher temperatures lead to their inactivation. SARS-CoV was detected in wastewater, domestic sewage, and tap water for 2 days at 20°C and up to 14 days at 4°C. Chlorine was considered far more effective against CoV than other microorganisms because of its lytic action on the envelope. None of the samples for SARS-CoV 1 were viable but the presence of coronaviridae was widespread.

- Table 5. La Rosa 2020. References of the Included Studies

MERS-CoV and SARs-CoV-1

MERS-CoV has been shown to infect human primary intestinal epithelial cells, small intestine explants and intestinal organoids.[8] MERS-CoV has been detected in 42% of milk samples collected from lactating camels where it can survive for a prolonged period. And in the largest hospital-associated MERS outbreak in the Republic of Korea in 2015 (n=186) a history of direct contact accounts for only one in ten cases.[9] A study of human primary intestinal epithelial cells and small intestine explants of MERS-CoV patterns identified the viral replication intermediates in stool specimen. MERS-CoV was found to be resistant to fed-state gastrointestinal fluids but less tolerant to the high acidic fasted-state gastric fluid.

In 1977 the prolonged excretion of coronaviruses was first observed in feces.[10] In the SARS-CoV-1 outbreak in 2002-03, a significant portion of patients had enteric involvement. For example, in the Toronto outbreak in 2003, 6% of 144 patients had diarrhoea on presentation.[11] Also among 138 patients with SARS in Hong Kong, 20% presented with watery diarrhoea and 38% had symptoms of diarrhoea during the illness. Intestinal biopsy specimens showed the presence of active viral replication, and SARS-CoV RNA was detected in the stool of some patients for more than ten weeks after symptom onset.[12] A retrospective study on specimens from 154 patients in Hong Kong with laboratory-confirmed SARS found the viral load to be the highest in stool specimens.[13] Up to 70% of 75 patients in a community outbreak in Hong Kong developed watery diarrhea.[14] This outbreak was linked to a faulty sewage system in the Amoy Gardens apartment complex, further suggesting orofecal transmission might be a route for transmission.[15]

The human gastrointestinal tract might be a primary infection site for SARS-CoV. Ding et al used a monoclonal antibody specific for the SARS-CoV nucleoprotein, and probes for the RNA polymerase gene fragment in four patients who died from SARS-CoV-1.[16] Virus was detected in the stomach, small intestine, distal convoluted renal tubule, sweat gland, parathyroid, pituitary, pancreas, adrenal, liver and cerebrum. The authors discussed that viruses in contaminated food and water may enter the human body through epithelial cells covering the surface of the gastrointestinal tract, although there was no direct evidence to show that food-borne transmission had occurred.

A study from the sewage of two hospitals receiving SARS patients in Beijing found no infectious SARS-CoV contamination in any of the samples collected, but did detect the nucleic acid in the sewage from the two hospitals before disinfection - providing further evidence that SARS-CoV-1 can be excreted by feces into the sewage system. [17]

Orofecal transmission

Orofecal transmission occurs with a number of viruses. Enteroviruses, for example, are positive-sense single-stranded RNA viruses and transmit through the intestine. They affect millions worldwide each year and can be found in respiratory secretions and the stool of infected persons. Over 90% of infected individuals with enteroviruses have no symptoms or have non-specific symptoms. Norovirus is largely spread by the orofecal route through person-to-person contact, contaminated food or water, or from the aerosolized vomit of an infected person. It often occurs among those living in close quarters and leads to outbreaks on cruise ships and healthcare facilities that often requires quarantining of the facilities. Transmission of norovirus, therefore, shares some similarities with SARs-CoV-2 including superspreading events.

Mounting evidence suggests that superspreading events have driven many of the local epidemics. Subsequent to identifying the index case in a French holiday chalet, SARS-CoV-2 was detected in 11 additional people [Danis K 2020]; a single case travelling on a bus and attending a mass gathering appeared to be responsible for infecting 25 individuals [Chen Y 2020]; and the transmission of SARS-CoV-2 in South Korea was exacerbated by super spreading events in confined settings, including a hospital, a church and a gym. [Shim E 2020]

Cluster sizes of more than 100 cases have been identified for hospitals, elderly care, worker dormitories, food processing plants, prisons, schools, shopping, religious events and ships.[18] The vast majority of these were indoor settings.

Some evidence suggests that close contact does not increase the risk of transmission. A convenience sample of 533 close contacts (404 actively monitored) of nine early travel-related cases in the United States identified two additional cases; both secondary cases were in spouses of travel-associated case-patients. [Burke 2020] No transmission was found among the 389 non-household contacts who completed active monitoring. For community contacts many reported having face-to-face contact (27/35; 77%) with the travel-associated case or spending time within 6 feet (34/38; 90%), and nearly all (43/45; 96%) could remember being in the same room as the travel-associated case-patient. Fewer (8/28; 29%) reported being within six feet of the patient while the patient was coughing. No community contacts were subsequently diagnosed with COVID-19.

While most human Coronaviruses are considered not to transmit fecally this is not the case in animals. Feline coronavirus, for instance, is typically shed in feces of healthy cats and transmitted by the orofecal route to other cats.[19] Pigs are also infected by the transmissible gastroenteritis coronavirus via the fecal-oral route.[20] Bat Coronavirus infects the gastrointestinal and respiratory tracts of bats seemingly without causing disease.[21]

Transmission following exposure to camel feces has also been considered to be biologically plausible, although no evidence indicates whether this is possible. [22]

There is, however, evidence that SARS-CoV-2 can survive adverse conditions in the gastrointestinal system. It has been identified in endoscopic specimens of the esophagus, stomach, duodenum, and rectum of COVID-19 patients; substantial amounts of SARS-CoV-2 RNA have been consistently detected in stool specimens. [DIng S 2020] Various observational and mechanistic evidence presented throughout this evidence brief supports the hypothesis that SARS-CoV-2 can infect and be shed from the human gastrointestinal tract.

Acknowledgment

Drs Susan Amirian and Siyuan Ding provided additional information for this brief.

Disclaimer: The article has not been peer-reviewed. The views expressed in this commentary represent the views of the authors and not necessarily those of the host institution, the NHS, the NIHR, or the Department of Health and Social Care. The views are not a substitute for professional medical advice. It will be regularly updated see the evidence explorer at https://www.cebm.net/evidence-synthesis/transmission-dynamics-of-covid-19/ for regular updates to the evidence summaries and briefs.

Authors:

Tom Jefferson is a senior associate tutor and honorary research fellow, Centre for Evidence-Based Medicine, University of Oxford. Disclosure statement is here

Elizabeth Spencer is Epidemiology and Evidence Synthesis Researcher at the Centre for Evidence-Based Medicine. (Bio and disclosure statement here)

Jon Brassey is the Director of Trip Database Ltd, Lead for Knowledge Mobilisation at Public Health Wales (NHS) and an Associate Editor at the BMJ Evidence-Based Medicine.

Carl Heneghan is Professor of Evidence-Based Medicine, Director of the Centre for Evidence-Based Medicine and Director of Studies for the Evidence-Based Health Care Programme. (Full bio and disclosure statement here)

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From: NASPHV Group on behalf of Barton Behravesh, Casey (CDC/DDID/NCEZID/OD)
To: WPCG30@LISTSERV.CDC.GOV
Subject: SARS-CoV-2 in pets, farmed mink on the December ZOHU Call
Date: Wednesday, November 18, 2020 6:36:14 PM

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Please share with interested colleagues.

You are invited to the December 2020 Zoonoses and One Health Updates (ZOHU) Call
Presented by CDC's One Health Office
December 2 - 2:00 - 3:00 PM ET

Scheduled Presentations:
1. SARS-CoV-2 Infection and Seropositivity among Pets of Persons with Laboratory-Confirmed SARS-CoV-2, 2020 - Grace Goryoka, MPH lie0@cdc.gov
2. One Health Investigation of SARS-CoV-2 on Multiple Mink Farms in Utah - Caitlin Cossaboom, DVM, PhD, MPH nrm9@cdc.gov AND Dean J. Taylor, DVM djtaylor@utah.gov

Free Continuing Education is available for multiple disciplines.
Zoom and phone connection information is available online at
https://www.cdc.gov/onehealth/zohu/2020/december.html
Subscribe to the ZOHU Call email newsletter to stay informed.

Casey

Casey Barton Behravesh MS, DVM, DrPH, DACVPM
Captain, U.S. Public Health Service
Lead, CDC COVID-19 One Health Working Group
Functional Box: OneHealth@cdc.gov

Director, One Health Office
National Center for Emerging and Zoonotic Infectious Diseases
Centers for Disease Control and Prevention
e-mail: CBartonBehravesh@cdc.gov and OneHealth@cdc.gov

For more information on our work, please visit:
www.cdc.gov/coronavirus/2019-ncov/animals/pets-other-animals.html

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From:	Wineland, Nora (MDARD)
To:	Holton, Jennifer (MDARD); Sielski, Jessy (MDARD); Schumacher, Kayleen (MDARD)
Cc:	Calogero, Jennifer (MDARD)
Subject:	FW: Mink TPs_Oct 7-MI
Date:	Wednesday, October 7, 2020 4:17:54 PM
Attachments:	Mink TPs_Oct 7-MI.docx

Fyi from CDC

From: Barton Behravesh, Casey (CDC/DDID/NCEZID/OD) <dlx9@cdc.gov>
Sent: Wednesday, October 7, 2020 3:59 PM
To: Wineland, Nora (MDARD) <WinelandN@michigan.gov>; Stobierski, Mary Grace (DHHS) <stobierskim@michigan.gov>
Cc: Carpenter, Ann (CDC/DDID/NCEZID/OD) <pzy4@cdc.gov>; Torres-Mendoza, Yaritbel (CDC/DDID/NCEZID/DFWED) <hvb0@cdc.gov>; One Health (CDC) <onehealth@cdc.gov>
Subject: Mink TPs_Oct 7-MI

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Nora and Mary Grace,

The latest version of CDC's talking points for SARS-CoV-2 and mink are attached. Please let us know if you have any questions.

Kindest Regards,

Casey

Casey Barton Behravesh MS, DVM, DrPH, DACVPM
Captain, U.S. Public Health Service
Director, One Health Office
CDC COVID-19 One Health Working Group Lead
National Center for Emerging and Zoonotic Infectious Diseases
Centers for Disease Control and Prevention
e-mail: CBartonBehravesh@cdc.gov
www.cdc.gov/coronavirus/2019-ncov/animals/pets-other-animals.html
www.cdc.gov/onehealth
Cell: 404 729 4107



From: Calogero, Jennifer (MDARD)
To: Stobierski, Mary Grace (DHHS); Signs, Kimberly (DHHS); Straka, Kelly (DNR); Duffiney, Anthony G - APHIS
Cc: Barr, Nancy (MDARD)
Subject: FW: Updated mink talking points
Date: Wednesday, October 21, 2020 11:37:00 AM
Attachments: Mink Talking Points.docx

FYI

From: Straily, Anne (CDC/DDPHSIS/CGH/DPDM) <yzv2@cdc.gov>
Sent: Wednesday, October 21, 2020 11:21 AM
To: Calogero, Jennifer (MDARD) <CalogeroJ@michigan.gov>
Subject: Updated mink talking points

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Good morning Jen,

I hope all is going well! I am sharing the updated mink talking points for your awareness. Let us know if you have any questions.

Thanks,
Anne

Anne Straily, DVM, MPH, DACVPM
CDC COVID-19 Emergency Response
Deputy, CDC COVID-19 One Health Working Group
Mobile: 470 464 4671 | yzv2@cdc.gov

From:	Wendling, Natalie (CDC/DDID/NCEZID/OD)
To:	One Health (CDC)
Cc:	Barton Behravesh, Casey (CDC/DDID/NCEZID/OD); Korslund, John A - APHIS; Tansey, Cassandra (CDC/DDID/NCEZID/DSR); Carpenter, Ann (CDC/DDID/NCEZID/OD); Murrell, Laura (CDC/DDID/NCEZID/OD); Basler, Colin A. (CDC/DDID/NCEZID/DFWED)
Subject:	People Working on Mink Farms: Prevent the Spread of COVID-19 Handout
Date:	Wednesday, December 30, 2020 4:05:37 PM
Attachments:	People-Working-on-Mink-Farms-Handout.pdf

CAUTION: This is an External email. Please send suspicious emails to abuse@michigan.gov

Dear state colleagues,

Attached is a new handout for producers and people working on mink farms in your state. This handout details the steps recommended to prevent the spread of SARS-CoV-2 among people and animals on these farms.

Please let us know if you have any questions.

Thank you!

Kind regards,
Natalie

Natalie M. Wendling, DVM, MPH, DACVPM
Lead, One Health Response Unit
CDC COVID-19 One Health Working Group
Functional Box: OneHealth@cdc.gov

Veterinary Medical Officer, One Health Office
National Center for Emerging and Zoonotic Infectious Diseases
Centers for Disease Control and Prevention
email: nwendling@cdc.gov
mobile (text): 843-814-0706

For more information on our work, please visit:
www.cdc.gov/coronavirus/2019-ncov/animals/pets-other-animals.html

www.cdc.gov/onehealth

From: Wendling, Natalie (CDC/DDID/NCEZID/OD)
To: Calogero, Jennifer (MDARD)
Cc: One Health (CDC)
Subject: RE: Updated Mink Talking Points: December 17, 2020
Date: Monday, December 21, 2020 12:43:44 PM
Attachments: EXTERNAL Mink Talking Points_Dec 17.docx

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Hi Jen,

Sure thing! Thank you for letting me know.

Please don't hesitate to reach out if you need anything else.

Warmest regards,

Natalie

From: Calogero, Jennifer (MDARD) <CalogeroJ@michigan.gov>
Sent: Monday, December 21, 2020 12:11 PM
To: Wendling, Natalie (CDC/DDID/NCEZID/OD) <pme8@cdc.gov>
Subject: RE: Updated Mink Talking Points: December 17, 2020

Hi Natalie,

Can you please add me to the email group that received the updated mink talking points?

Thanks so much,
Jen

Jennifer Calogero, DVM, PhD
Program Manager
Michigan Department of Agriculture and Rural Development
Animal Industry Division
calogeroj@michigan.gov
517-284-5692 (office)
517-614-0207 (cell)

From: Wineland, Nora (MDARD) <WinelandN@michigan.gov>

Sent: Monday, December 21, 2020 12:06 PM
To: Calogero, Jennifer (MDARD) <CalogeroJ@michigan.gov>
Subject: FW: Updated Mink Talking Points: December 17, 2020

From: Wendling, Natalie (CDC/DDID/NCEZID/OD) <pme8@cdc.gov>
Sent: Thursday, December 17, 2020 3:49 PM
To: One Health (CDC) <onehealth@cdc.gov>
Cc: Barton Behravesh, Casey (CDC/DDID/NCEZID/OD) <dlx9@cdc.gov>; Murrell, Laura (CDC/DDID/NCEZID/OD) <wjl9@cdc.gov>; Carpenter, Ann (CDC/DDID/NCEZID/OD) <pzy4@cdc.gov>
Subject: Updated Mink Talking Points: December 17, 2020

CAUTION: This is an External email. Please send suspicious emails to abuse@michigan.gov

Dear state colleagues,

Attached is an updated mink talking points document for your reference. Please note that this is a working document and we will continue to provide updates as we learn more.

Please let us know if you have any questions.

Thank you.

Warmest regards,
Natalie

Natalie M. Wendling, DVM, MPH, DACVPM
Lead, One Health Response Unit
CDC COVID-19 One Health Working Group
Functional Box: OneHealth@cdc.gov

Veterinary Medical Officer, One Health Office
National Center for Emerging and Zoonotic Infectious Diseases
Centers for Disease Control and Prevention
email: nwendling@cdc.gov
mobile (text): 843-814-0706

For more information on our work, please visit:
www.cdc.gov/coronavirus/2019-ncov/animals/pets-other-animals.html

-
www.cdc.gov/onehealth

From: Duffiney, Anthony G - APHIS
To: Calogero, Jennifer (MDARD)
Subject: RE: Updated mink talking points
Date: Wednesday, October 21, 2020 1:56:18 PM

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Thanks Jen!

Tony Duffiney
State Director
USDA APHIS Wildlife Services
2803 Jolly Road, Suite 100
Okemos, MI 48864
(517) 318-3461 (Direct Line)
(517) 336-1934 (Fax)
(517) 719-9165 (Cell)
anthony.g.duffiney@usda.gov

From: Calogero, Jennifer (MDARD) <CalogeroJ@michigan.gov>
Sent: Wednesday, October 21, 2020 11:38 AM
To: Stobierski, Mary Grace (DHHS) <stobierskim@michigan.gov>; Signs, Kimberly (DHHS) <signsk@michigan.gov>; StrakaK1@michigan.gov; Duffiney, Anthony G - APHIS <anthony.g.duffiney@usda.gov>
Cc: barrn@michigan.gov
Subject: FW: Updated mink talking points

FYI

From: Straily, Anne (CDC/DDPHSIS/CGH/DPDM) <yzv2@cdc.gov>
Sent: Wednesday, October 21, 2020 11:21 AM
To: Calogero, Jennifer (MDARD) <CalogeroJ@michigan.gov>
Subject: Updated mink talking points

CAUTION: This is an External email. Please send suspicious emails to abuse@michigan.gov

Good morning Jen,

I hope all is going well! I am sharing the updated mink talking points for your awareness. Let us know if you have any questions.

Thanks,

Anne

Anne Straily, DVM, MPH, DACVPM
CDC COVID-19 Emergency Response
Deputy, CDC COVID-19 One Health Working Group
Mobile: 470 464 4671 | yzv2@cdc.gov

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