One Health: An examination of the global reach of COVID-19

Lidwien A.M. Smit, PhD
Associate Professor
Institute for Risk Assessment Sciences
Utrecht University, The Netherlands

@LidwienSmit  L.A.Smit@uu.nl
**One Health:**
Human, animal and environmental health are tightly interconnected and need to be studied in the context of each other.
Taxonomy of Coronaviridae
One Health approach: WHO-convened Global Study of Origins of SARS-CoV-2

- Direct zoonotic spillover (possible-to-likely)
- Intermediate host (likely to very likely)
- Cold/food chain products (possible)
- Laboratory incident (extremely unlikely)

WHO, 30 March 2021
Why study COVID-19 using a One Health approach?

- Prevent animal-to-animal and animal-to-human transmission
- Monitor new mutations that may be seen as the virus adapts to a new species
- Prevent establishment of new zoonotic reservoirs
- Prevent future spillovers
Timeline first reports of Covid-19 in animals (2020)

February
- Hongkong Dog 2/30
- Cat 1/17
- Hamster 0/2

March
- Cats and ferrets can transmit the infection
- Study demonstrated 15% seropositive cats in Wuhan

April
- 23 April
  First infected mink farm (The Netherlands)
- Tigers, lions in New York zoo
- 17 infected mink farms in NL (1 July)

May
- Fruit bats, hamsters, rabbits can be infected in contrast to pigs, chickens and ducks

June
- 2 infected mink farms DK
The Netherlands: densely populated, urban and agricultural air pollution

- Pig farms
- Ammonia air pollution
- Q fever patients in 2009 epidemic

Hospitalizations until June 12, 2020

School vacation Feb/Mar 2020

Carnival

(Based on: NIVD 2019)
One Health approach to SARS-CoV-2 outbreak investigation on mink farms

- **ANIMAL** - Spread of infection in minks and farm cats and dogs?
- **ENVIRONMENT** - Viral contamination in mink houses and outdoor air?
- **HUMAN** - Spillover events to humans?
SARS-CoV-2 infection in mink farms

- Initiated by human-to-mink transmission
- Until end 2020: 69 farms in NL infected - despite preventive measures
- January 2021: mink farming in NL banned
- Worldwide, 10 countries reported infected mink farms

Oreshkova et al. Eurosurveillance 2020
Molenaar et al. Vet Pathol 2020
Mink-to-cat transmission

Evidence of SARS-CoV-2 infection in 12 feral cats and 2 dogs

Serum ELISA and VNT+ : 11/62 (17.7%) cats and 2/13 (15.4%) dogs
Throat swab PCR+ : 3/99 cats (3%) and 1/13 dogs (8%)

One cat sequence generated: clustered with mink sequences
Mink-to-cat most likely route of introduction

Van Aart et al. manuscript under review.
Environmental sampling SARS-CoV-2 RNA

Mink housing  
Indoor air  
Outdoor air, premises  
Outdoor air >25m from farm

De Rooij et al. manuscript under review.
Mink-to-human infections

- At the first 16 farms, 66/97 mink workers/family tested positive (68%)

- All 18 human sequences were near-identical to mink or clustered deeply within the mink sequences

No spillover to nearby human population

- All COVID-19 patients in the area that could be sequenced had different virus sequences
Lessons learned for future challenges

One Health ~ Planetary Health

Close collaboration between animal, public health, and environmental authorities and scientists is imperative to better understand and prevent emerging infectious and non-infectious diseases