

Influenza D virus and Rotavirus A in Danish calves

What do we know?

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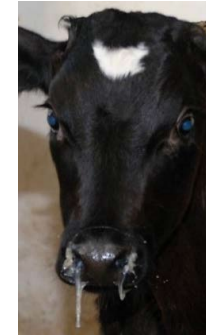
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Main focus

- Influenza D Virus
 - Respiratory virus
 - Symptoms - fever, coughing, eye and nasal discharge
 - Clinical relevance?

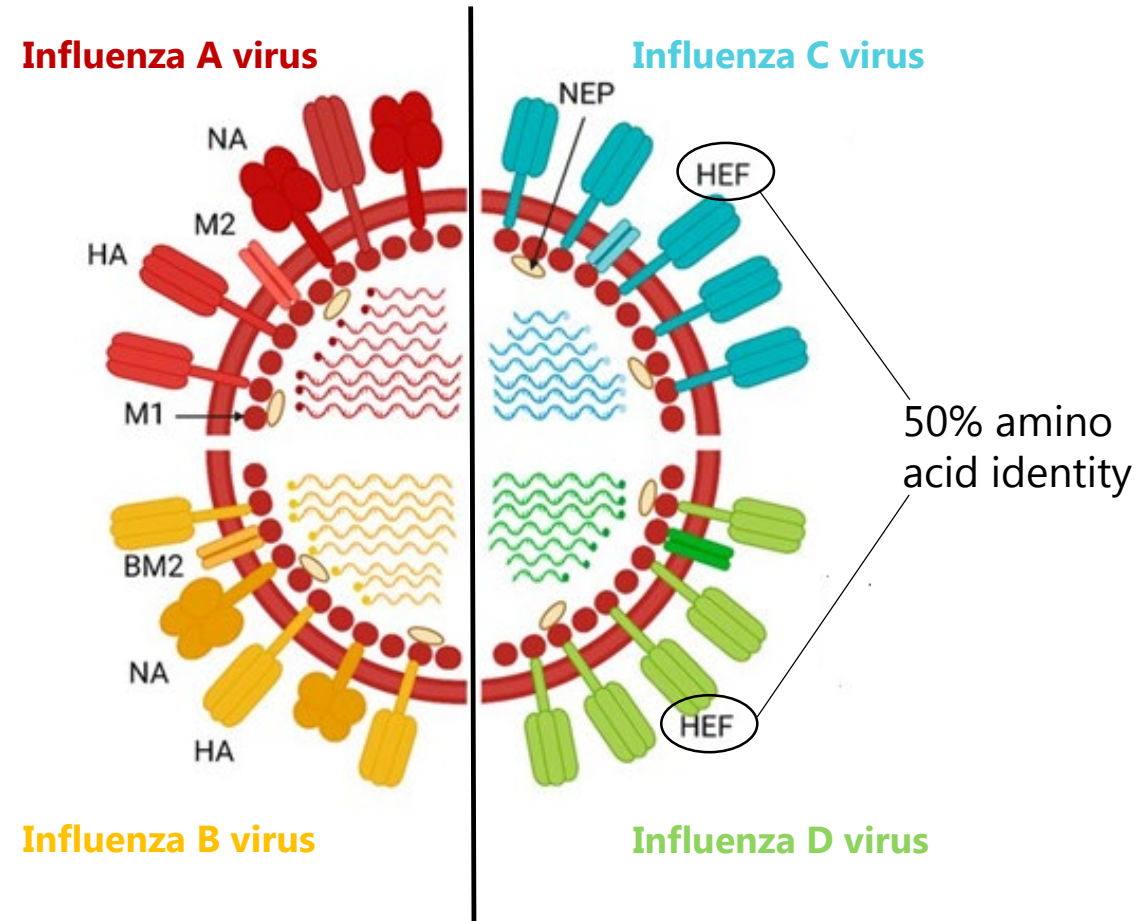


- Rotavirus A
 - Enteric virus
 - Symptoms – diarrhoea (young calves)

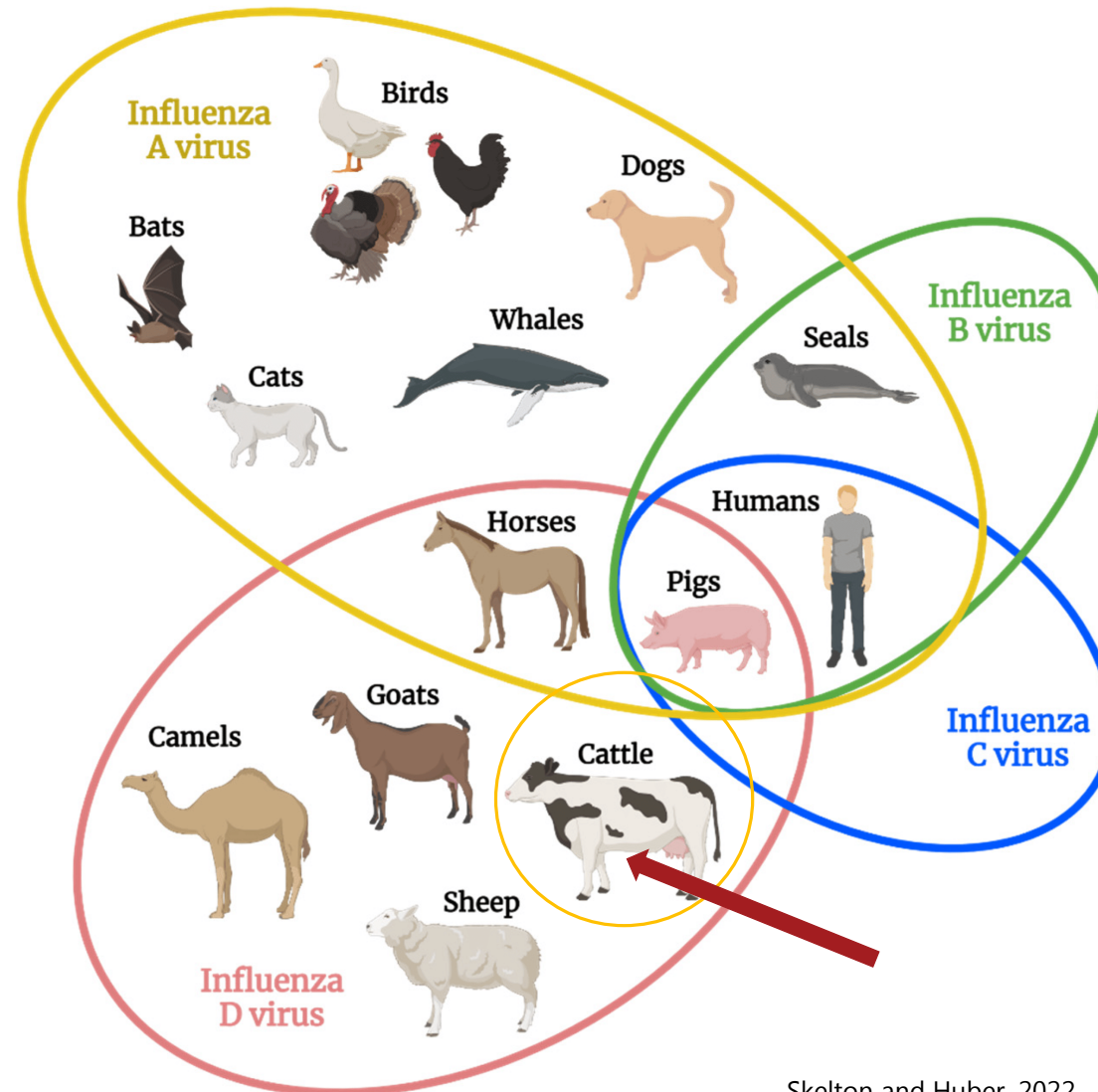


Influenza D virus

Structure of Influenza viruses (A, B, C, D)



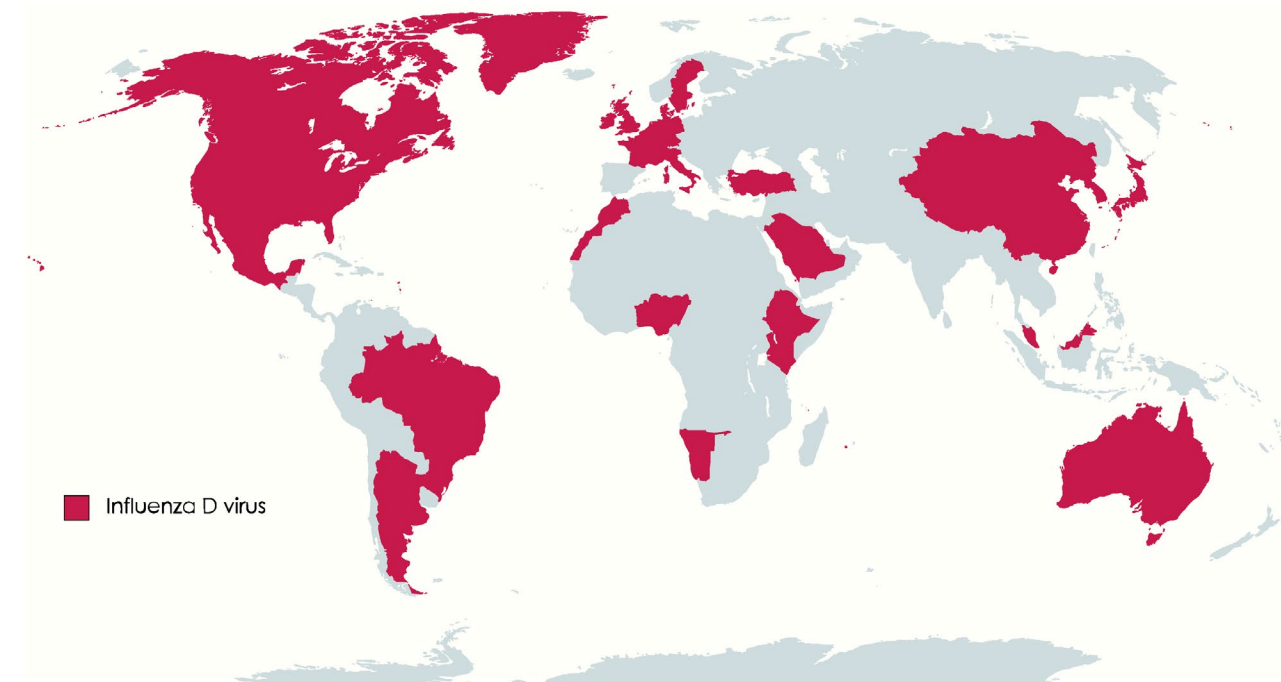
Host ranges of Influenza viruses



Occurrence and role of Influenza D virus

- Global distribution
- Bovine respiratory disease complex (BRDC)
 - A multifactorial disease
 - A causative agent of BRDC?

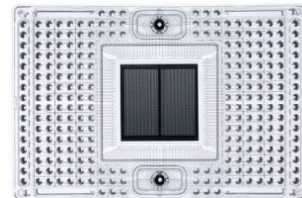
Influenza D virus in domestic and wild animals



Occurrence of Influenza D virus in Danish calves

- Project Robust calves 2018-2021
 - Nasal swab and fecal samples - 100 Danish herds (83 dairy and 17 veal cattle herds)

High-throughput real-time PCR system



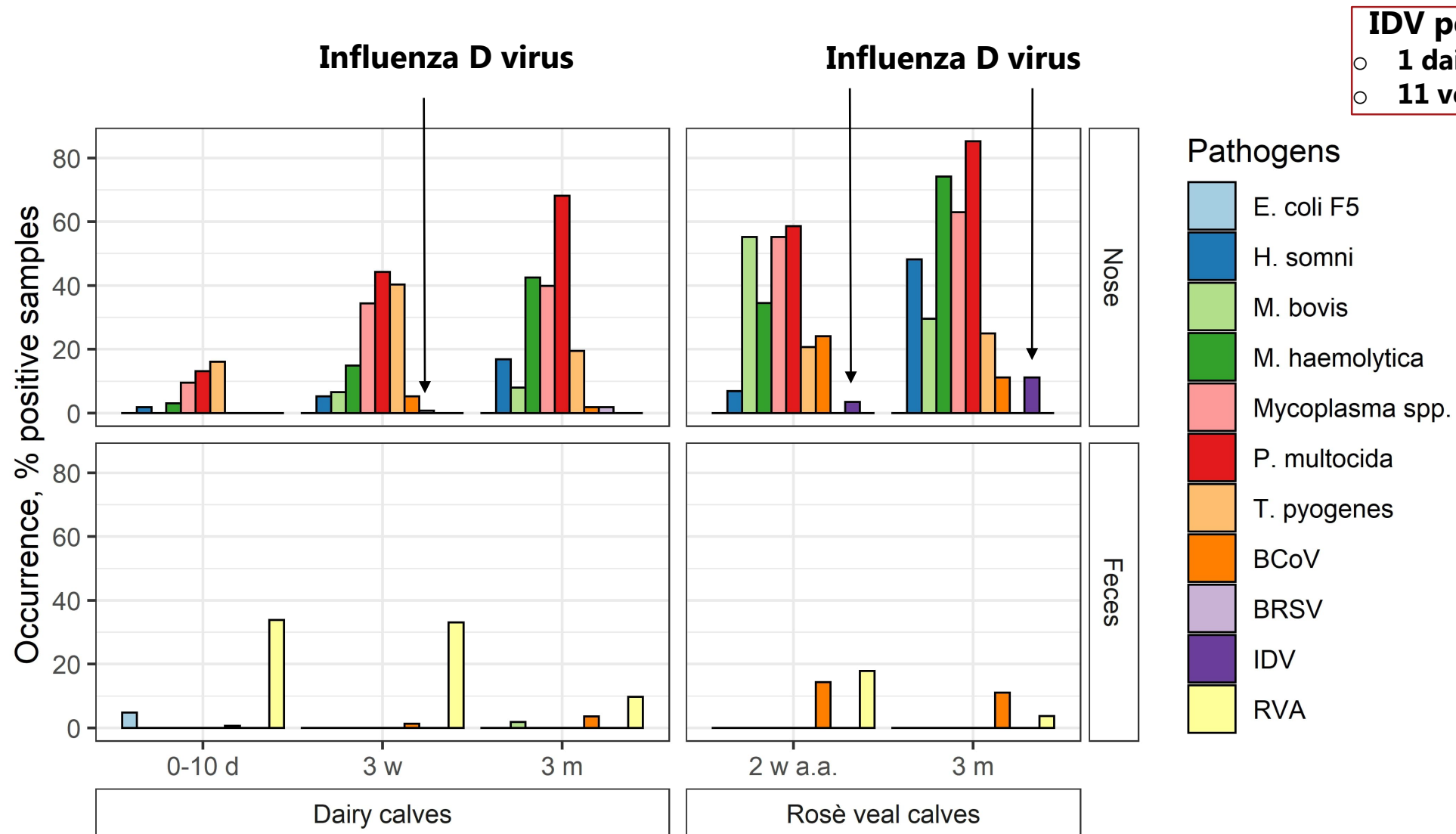
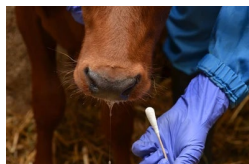
Viruses

Bovine coronavirus (BCoV)
Bovine Parainfluenza 3 (BPi3)
Bovine respiratory syncytial virus (BRSV)
Influenza D virus (IDV)
Rotavirus A (RVA)

Bacteria

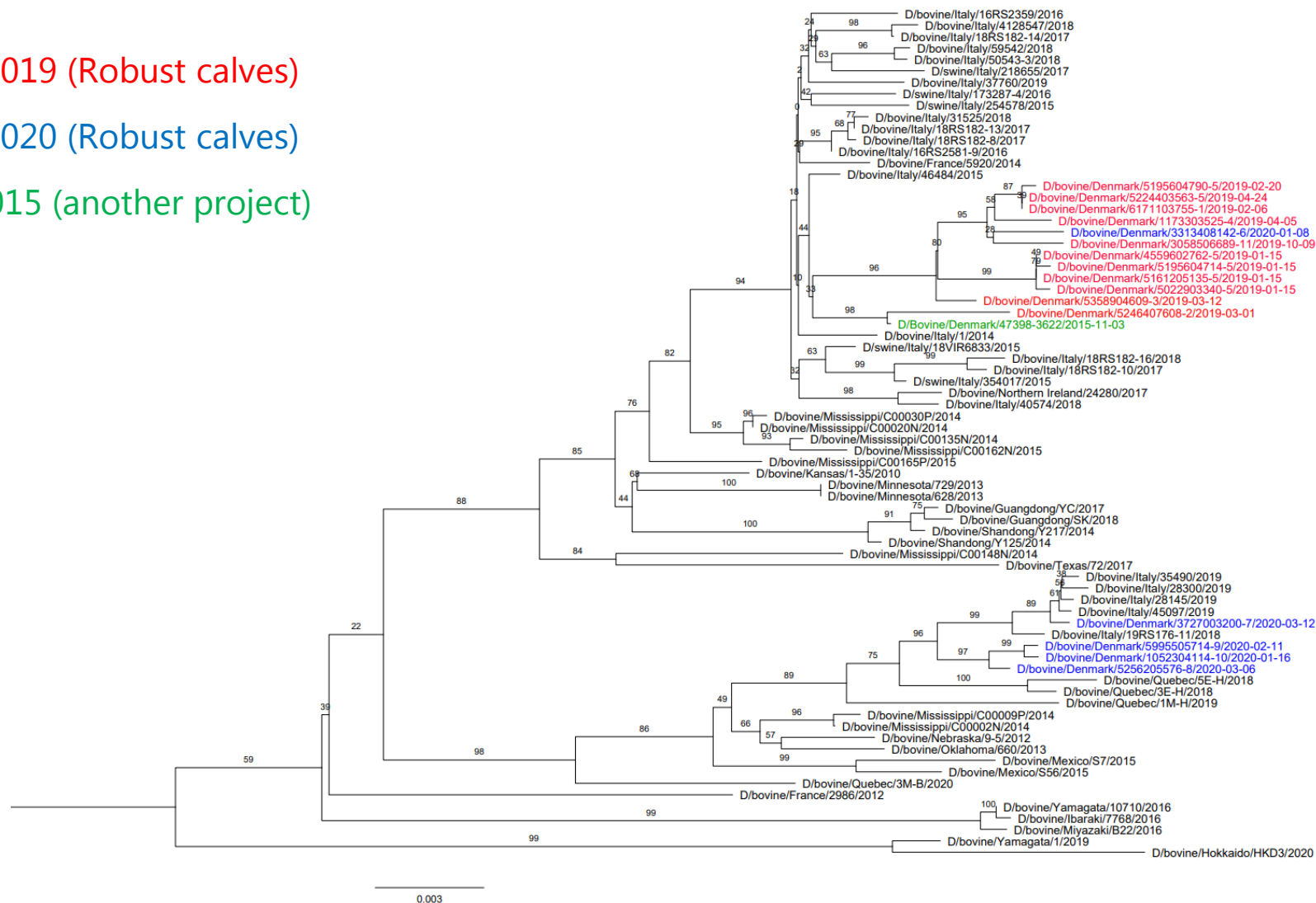
Mannheimia haemolytica
Pasteurella multocida
Histophilus somni
Mycoplasma spp.
Mycoplasma bovis
Trueperella pyogenes
Escherichia coli F5

Influenza D virus was detected in the Robust calves project



Phylogeny of Influenza D virus – HEF gene

- Samples collected in 2019 (Robust calves)
- Samples collected in 2020 (Robust calves)
- Sample collected in 2015 (another project)



D/OK

D/660

D/Yama16

D/Yama19

Infection dynamics of Influenza D virus – KAF2024 project

- Screening of IDV in nine veal cattle herds

- Four age groups (7-12 calves per group)

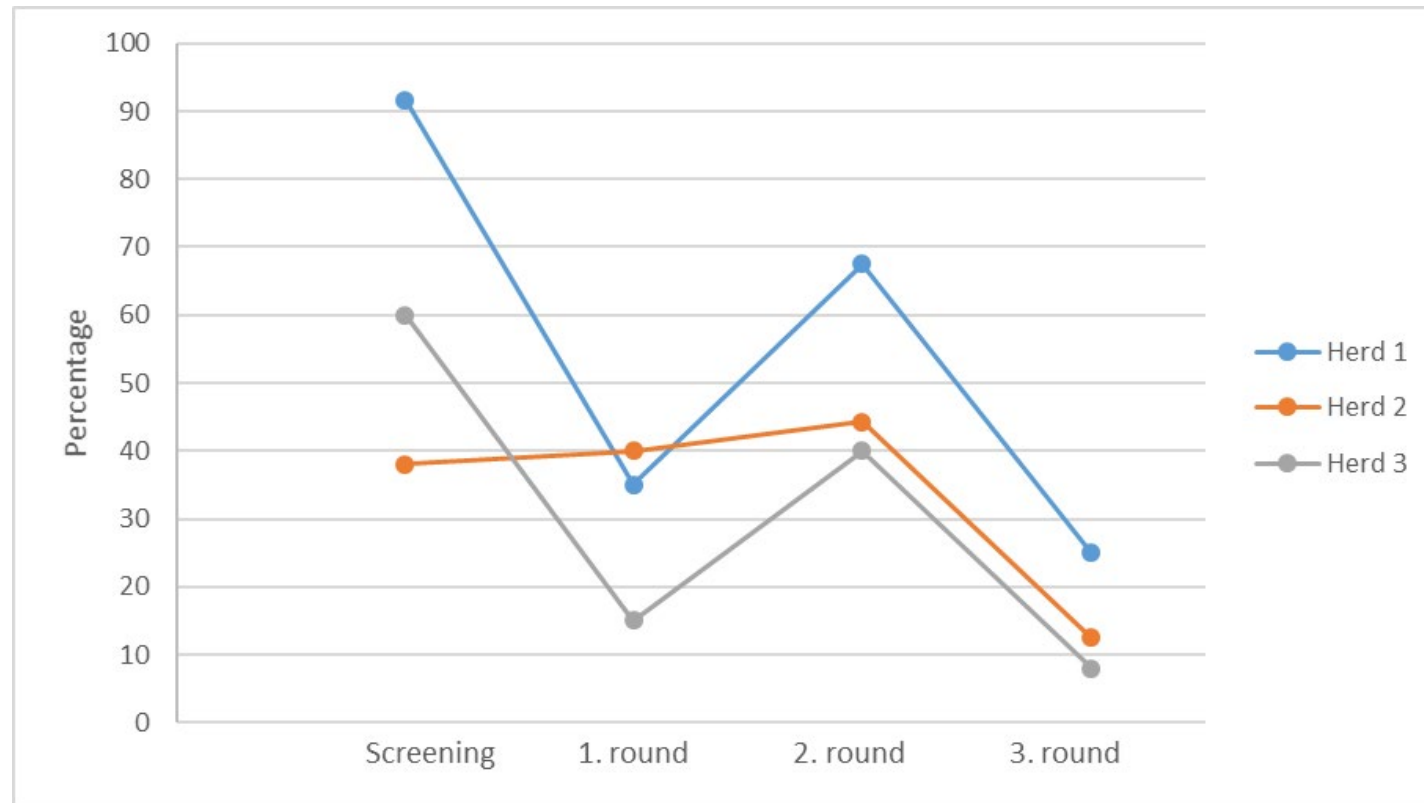
- 1) Recently arrived
- 2) 2 weeks after arrival
- 3) 3 months of age
- 4) 6 months of age



- Three herds tested positive (33%) → followed for three-four months

The infection dynamics of Influenza D virus over time

- Sampling rounds
 - Screening: 38-92%
 - 1. round: 15-40%
 - 2. round: 40-68%
 - 3. round: 8-25%



The infection dynamics of Influenza D virus in different age groups

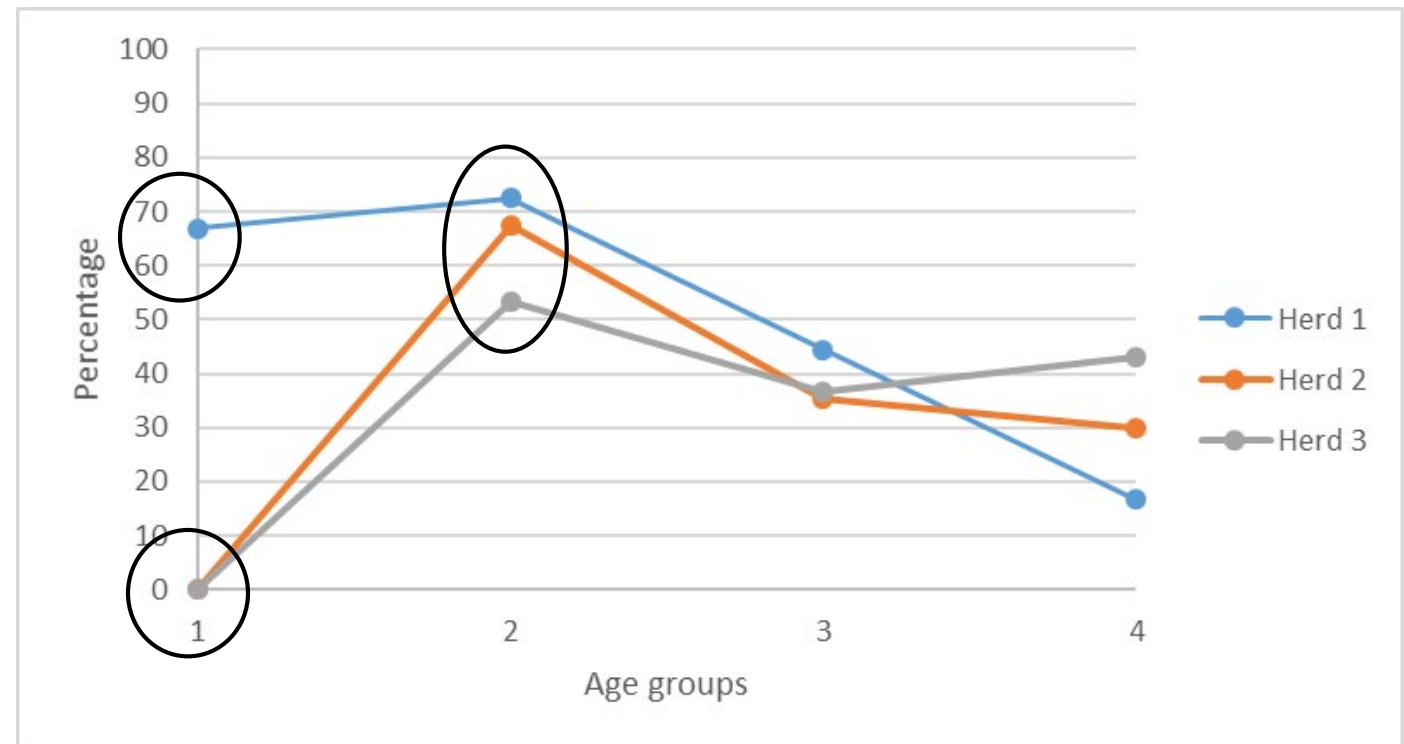
- Age groups
 - 1) Recently arrived: 0-67%
 - 2) 2 weeks after arrival: 53-73%
 - 3) 3 months of age: 35-44%
 - 4) 6 months of age: 17-43%

Number of suppliers

Herd 1: 13-25

Herd 2: 6-12

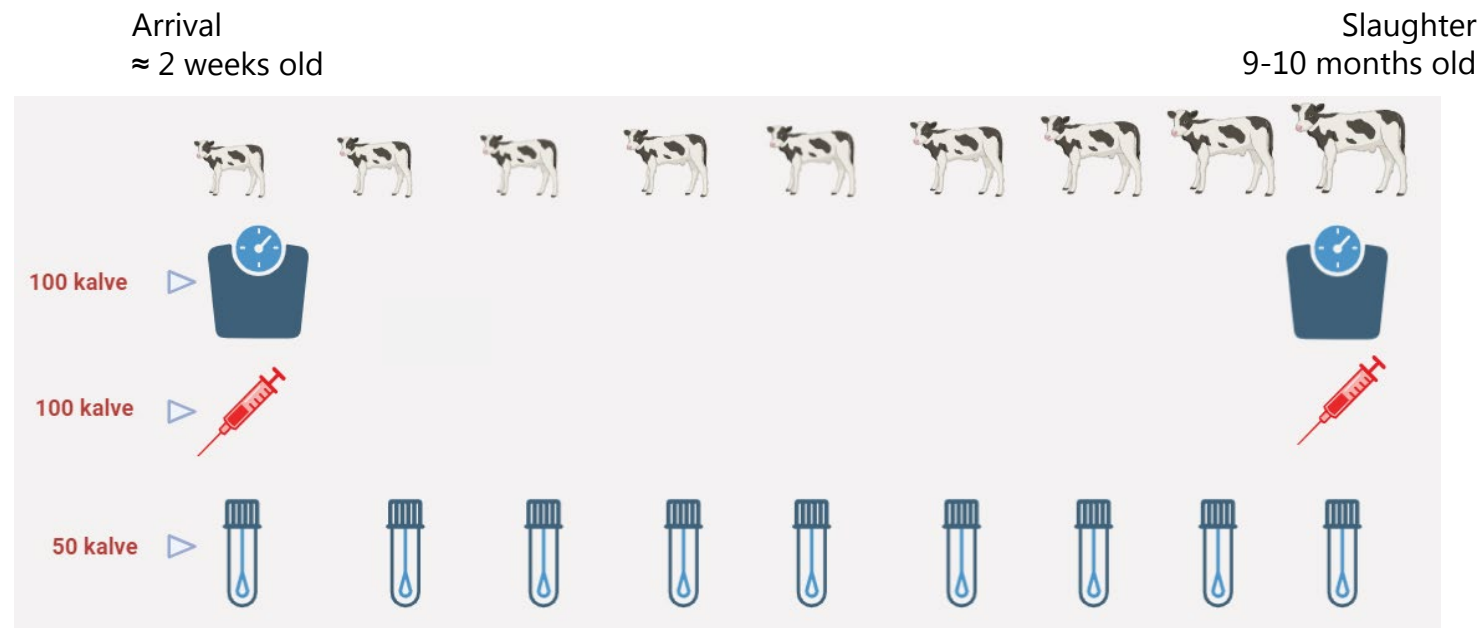
Herd 3: >40



Further investigations of Influenza D virus - KAF2025

○ Aims

- Investigate which strain(s) is circulating
- Investigate whether calves can be infected multiple times
- Investigate the impact of Influenza D virus infection on health and productivity





Rotavirus A

Rotavirus (RV) - General information

- Classification - ten species (A–J)
 - Rotavirus A (RVA), RVB, RVC and RVH: humans and animals
 - RVD, RVE, RVF, RVG, RVI and RVJ: only animals

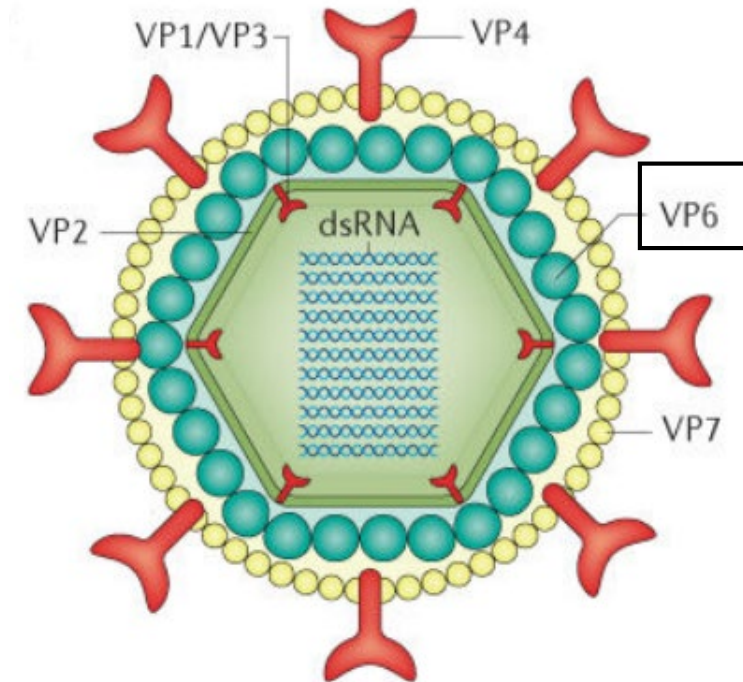
- Rotavirus species in Denmark



RVA, RVB, RVC and RVH



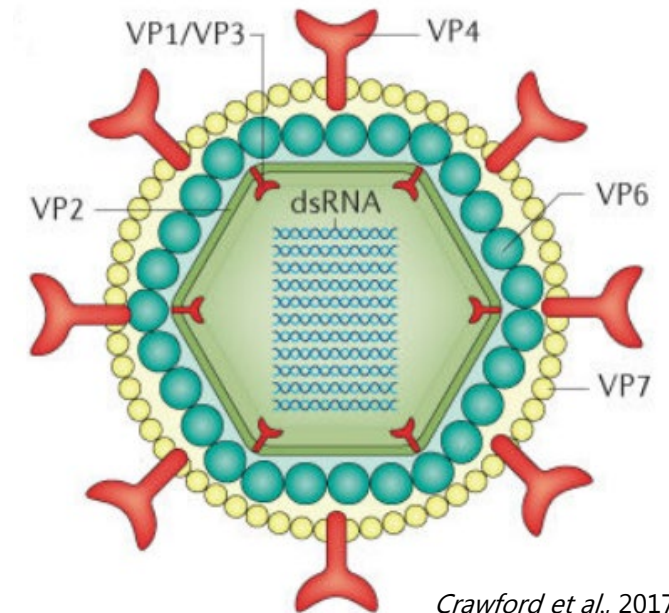
RVA – other rotavirus species?



Rotavirus (RV) - General information

- The genome is composed of 11 segments of dsRNA
 - Six structural viral proteins (VP1-6)
 - Five non-structural proteins (NSP1-5/6)
- Genes: **VP7-VP4-VP6-VP1-VP2-VP3**-NSP1-NSP2-NSP3-NSP4-NSP5/6

Gx P[x] Ix Rx Cx Mx Ax Nx Tx Ex Hx



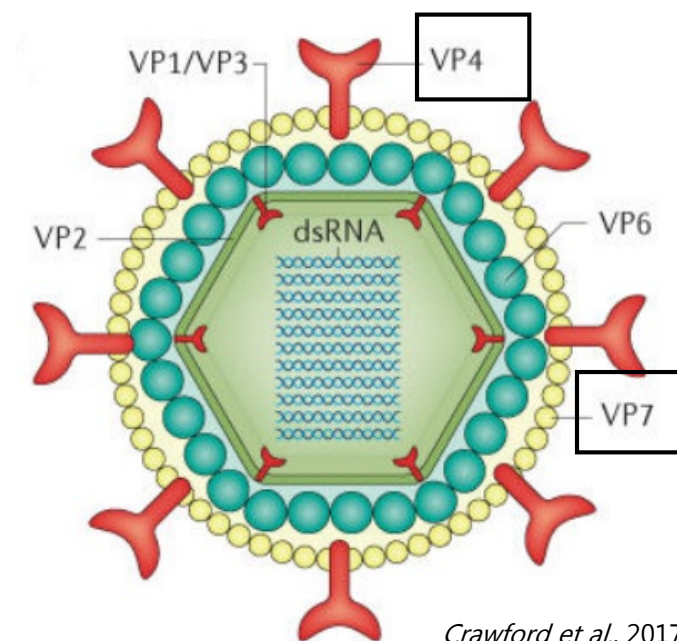
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↓ ↓

Genotyping



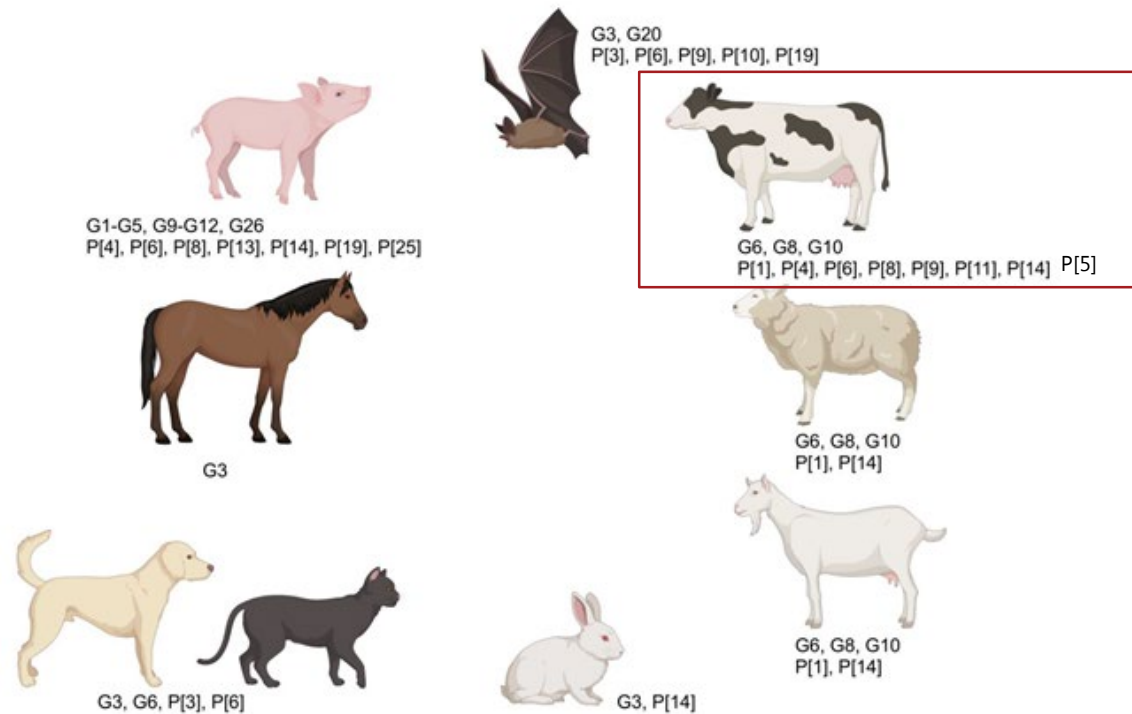
Rotavirus A genotypes

- Genes: **VP7-VP4-VP6-VP1-VP2-VP3**-NSP1-NSP2-NSP3-NSP4-NSP5/6

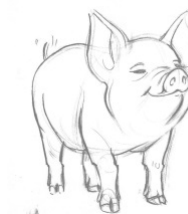
Gx P[x] Ix Rx Cx Mx Ax Nx Tx Ex Hx

↓ ↓
Genotyping

37 G and 52 P genotypes
have been found

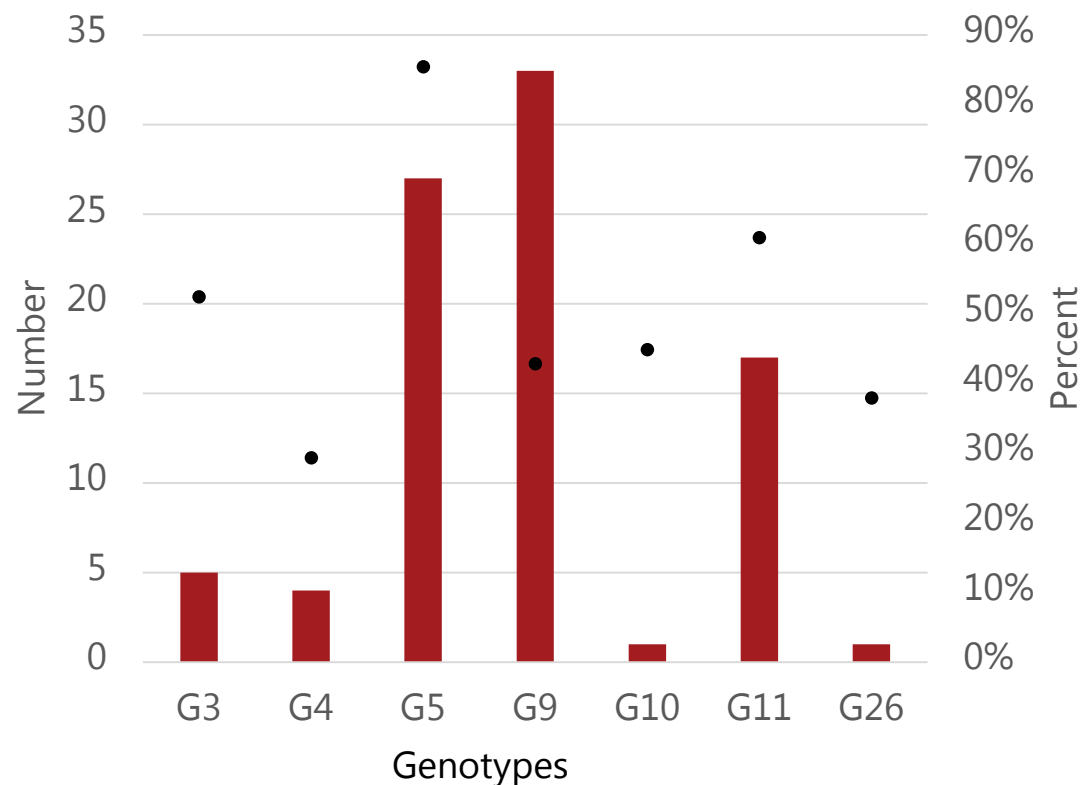


Rotavirus A genotypes and vaccine efficacy



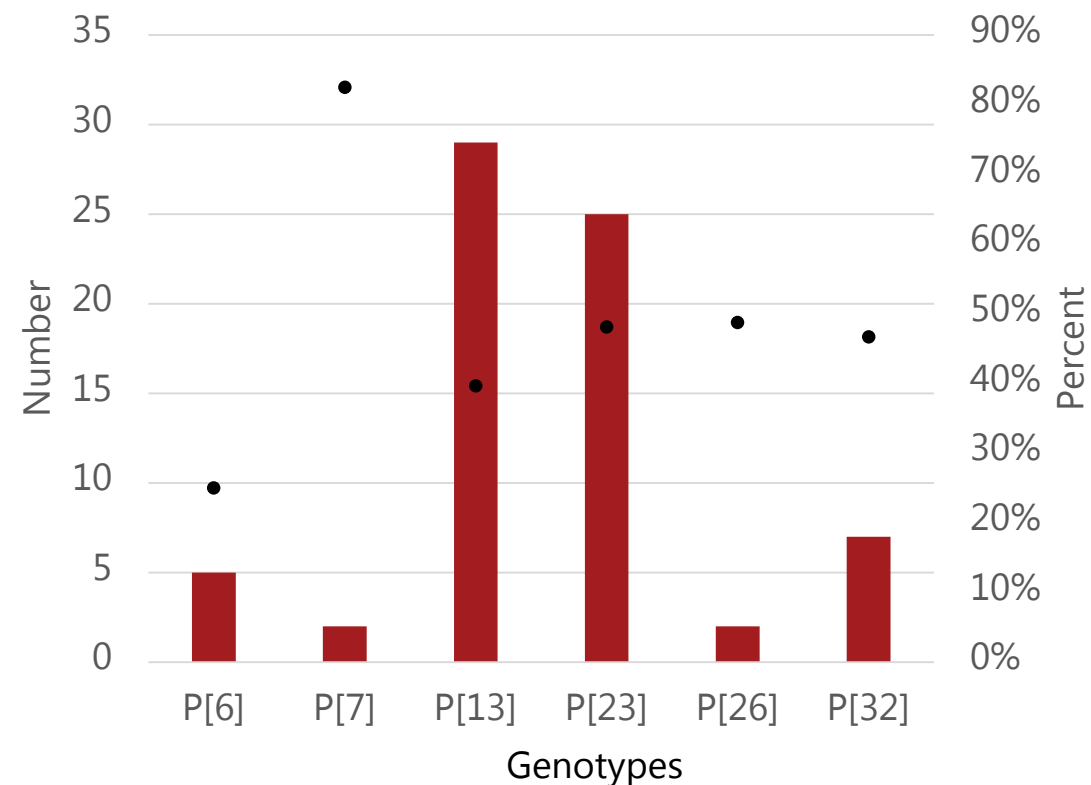
**RVA vaccine
G5P[7]**

VP7



- Amino acid similarity to the antigenic epitopes of the vaccine strain (G5)

VP4

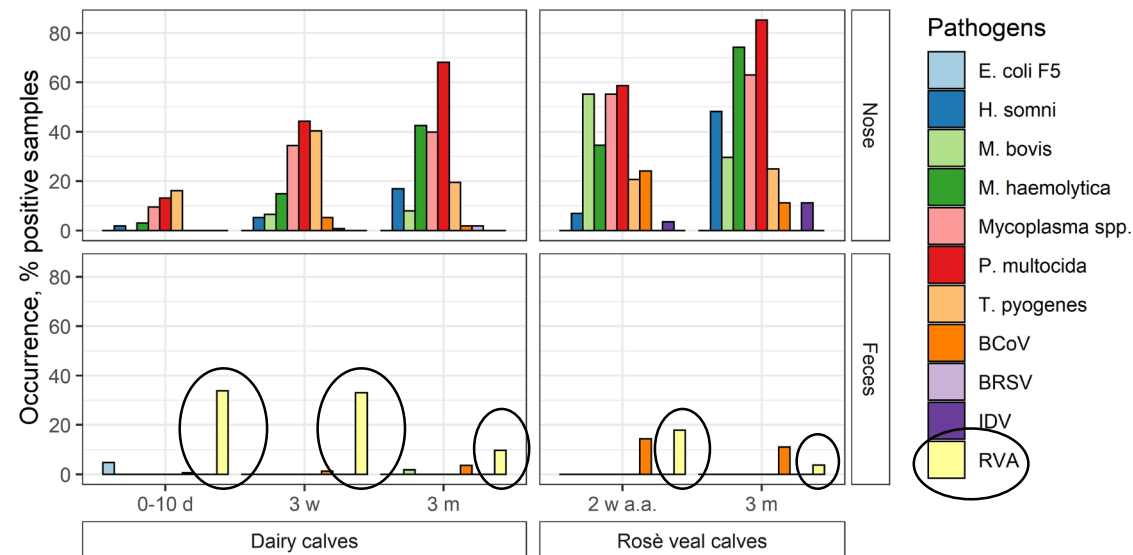


- Amino acid similarity to the antigenic epitopes of the vaccine strain (P[7])

Which genotypes of Rotavirus A are present in Danish calves?



- Vaccines
 - Bovigen RCE Vet., Virbac - **G6P[1]**
 - Bovilis Rotavec Corona Vet., MSD - **G6P[5]**



- Robust calves project
 - 55/100 herds tested positive for RVA

Preliminary results

- Genotypes detected in five herds
 - ✖ G6P[5] – one herd
 - ✖ G6P[11] – two herds
 - ✖ G10P[11] – two herds

Type	Country				
	Denmark	France	Hungary	Italy	Slovenia
Single type infections					
G4 P[5]	1				
G6 P[1]					2
✖ G6 P[5]	15	23		53	2
✖ G6 P[11]	2	3	1	112	2
G8 P[1]		1			
G8 P[5]				1	
G8 P[11]				9	
G10 P[5]				4	
✖ G10 P[11]	2	8		18	
G12 P[5]	2				

Further investigations of Rotavirus A genotypes – KAF2025

- Complete the genotyping
- Sample 20 dairy herds that vaccinate against Rotavirus A
 - Faeces and blood samples (calves 0-4 weeks of age)
 - Genotypes related to vaccine
- Investigate which other rotavirus species are present



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Questions?