Swine Influenza Virus Surveillance – Canada

- Yohannes Berhane
- National Centre for Foreign Animal Disease
- Winnipeg, Manitoba, Canada

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2. Influenza A swine in other species
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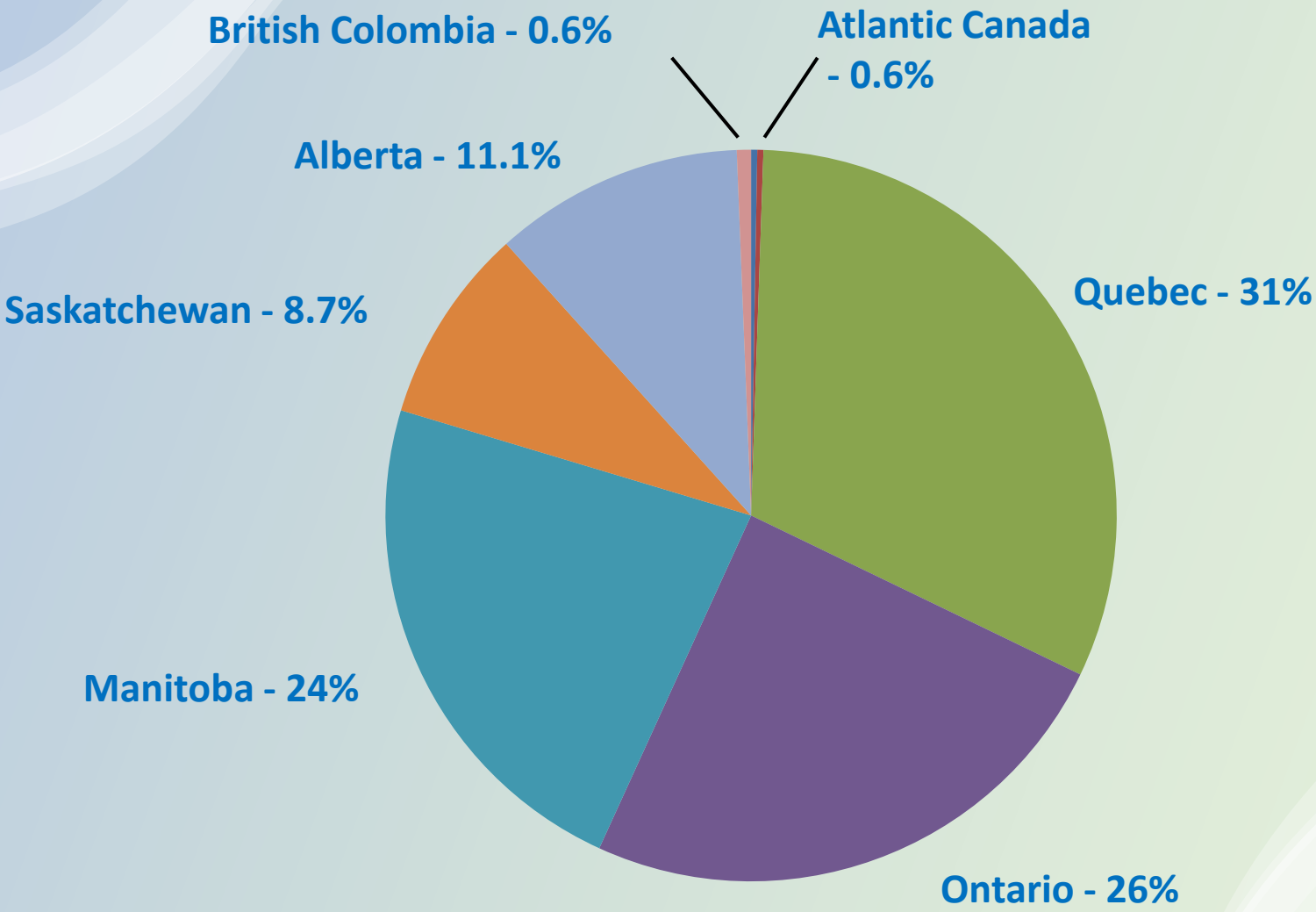
Canadian Pig Inventory 2022



14.17 million

Project Collaborators on SIV

- Collaboration between NCFAD, Winnipeg and Quebec, Ontario and Manitoba
- Laboratoire d'Epidemio-surveillance Animale du Quebec (LEAQ) and Bio-Vet – St-Hyacinthe, Quebec
- Animal Health Laboratory (AHL) – Guelph, Ontario
- Manitoba Agriculture, Food and Rural Development (MAFRD), Veterinary Diagnostic Services – Winnipeg, Manitoba

Swine H1N1/N2 Isolates

	2023/24 (H1N1/N2)			
Province	1A.1.1 (Alpha)	1A.3.3.2 npdm	1A.2 Beta (98)	Gamma
Ontario	96	58	30	0
Quebec	35	19	28	0
Manitoba	15	6	-	3
Saskatchewan	5	-	-	-
Alberta	2	-	-	-

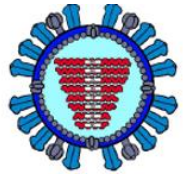
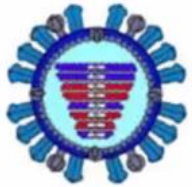
Swine H3N2 Isolates

	2023/24 (H3N2)			
Province	H3 2010.1	Cluster IVB	Cluster IVA	Cluster IV
Ontario	69	25	0	19
Quebec	0	32	0	26
Manitoba	0	7	0	10
Saskatchewan	-	-	-	-
Alberta	-	-	-	-

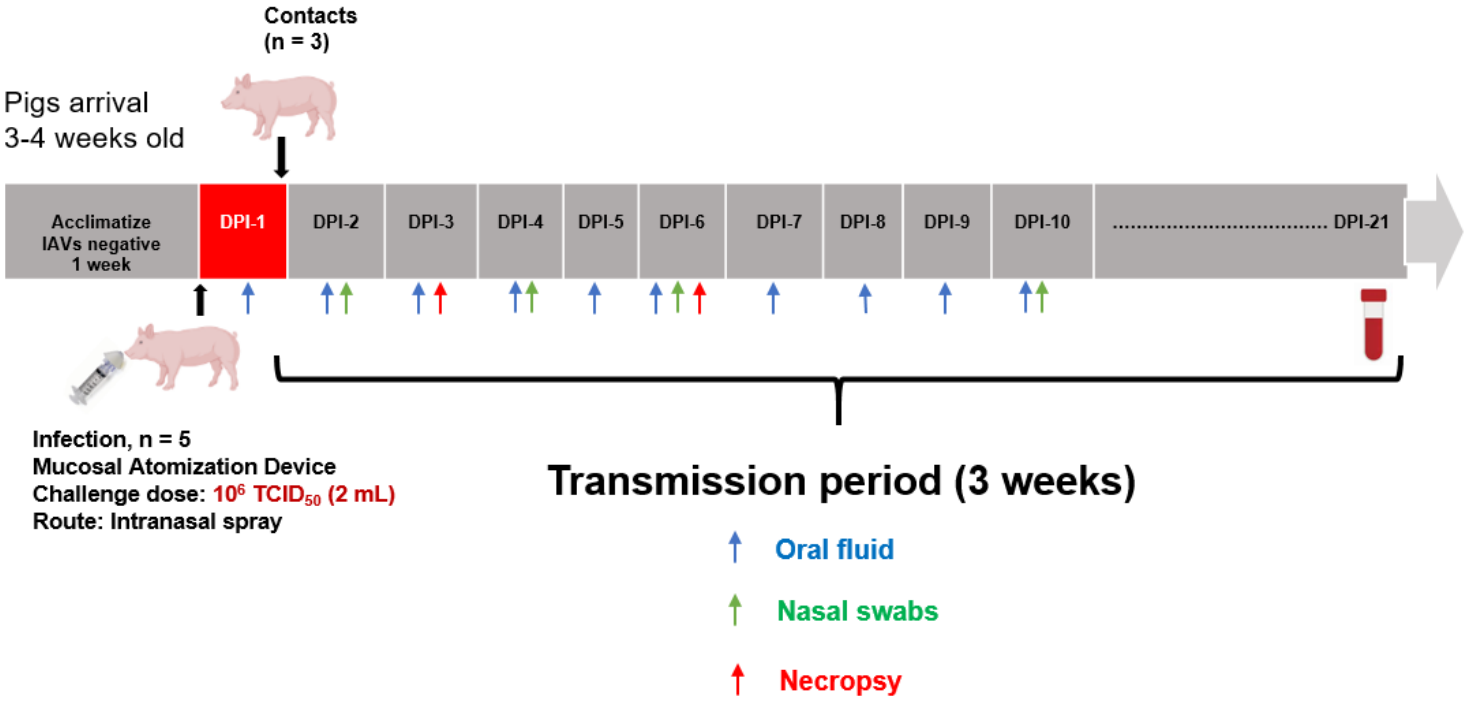
Influenza A swine in other species

- No cases in humans with influenza A swine reported in 2023/24
- 3 cases of H3N2 – cluster IV in turkeys – Ontario
- Few cases of turkeys with H1 and H3 antibodies
- 1 case of H3N2 cluster IV in farmed mink

Highly pathogenic avian influenza viruses

HPAI Viruses (Clade 2.3.4.4b)	Genotypes	Reassortment patterns
Skunk/PEI/Fav0210/2023 **Wholly Eurasian genes** **H5N5** virus, **PB2-627K**	**EA6**	
Skunk/AB/Fav1655-3/2022 PB2, PB1, NP, NS – NAm lineage **H5N1** virus, **PB2-627K**	**B3.2**	
Turkey/QC/Favv168-1/2023 PB2, PB1, NP, NS – NAm lineage **H5N1** virus, **PB2-627K**	**B3.2**	
RT.Hawk/ON/Fav473-4/2022 PB2, PB1, NP – NAm lineage **H5N1** virus, **PB2-627K**	**B1.1**	

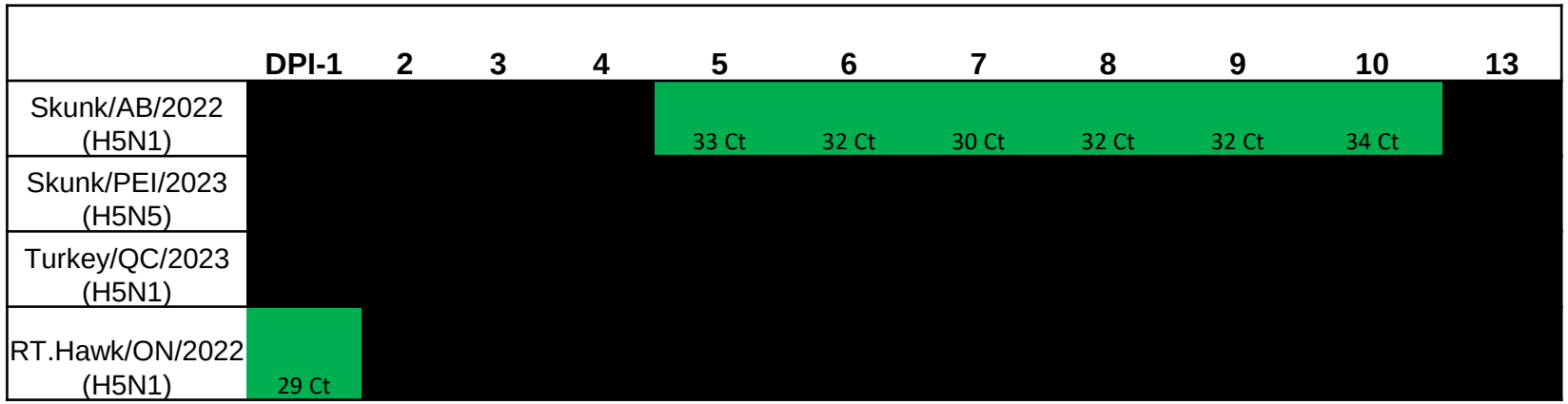
Infection trials



Clinical evaluation

- All infected and contact pigs appeared apparently healthy
- No mortality

Virus detection in oral fluids (rope samples): M-PCR Ct-values



- Persistent and low level nasal/oral shedding: Skunk/AB/2022 (H5N1)

Virus detection in nasal swabs: M-PCR Ct-values

	2dpi/1dpc		4dpi/3dpc		6dpi/5dpc		10dpi/9dpc	
	Infected	Contact	Infected	Contact	Infected	Contact	Infected	Contact
Skunk/AB/2022 (H5N1)	2/5 (30-31 Ct)							
Skunk/PEI/2023 (H5N5)								
Turkey/QC/2023 (H5N1)								
RT.Hawk/ON/2022 (H5N1)	3/5 (29-31 Ct)				1/4 (34 Ct)			

Dpi: days post-infection
Dpc: days post-contacts

- Generally, low levels virus shedding

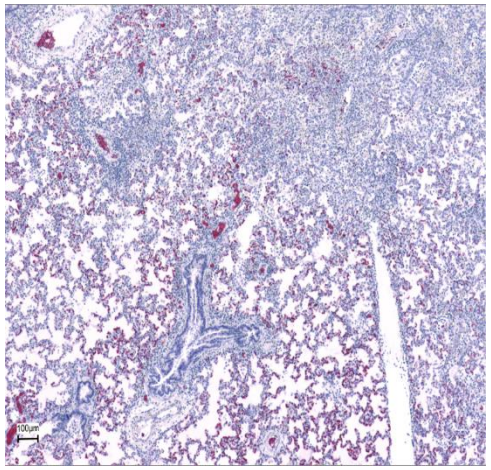
Virus detection- tissue homogenates: **M-PCR Ct-values**

	3 dpi			6 dpi			3 dpi (lung homogenates)				
	Adrenal	Duodenum	Pancreas	Adrenal	Duodenum	Pancreas	Cranial R	Cranial L	Mid R	Caudal R	Caudal L
Skunk/AB H5N1	36	36	34				34	34	19	32	35
Skunk/PEI H5N5					35			37	27	36	
Turkey/QC H5N1									38		
RTHawk/ON H5N1			37		35					38	

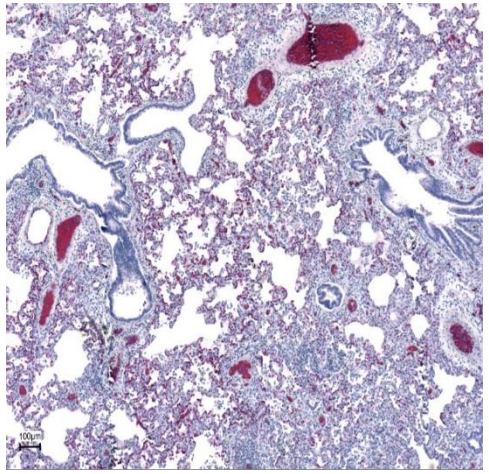
- Generally, low levels virus detection in the lungs and other tissues.

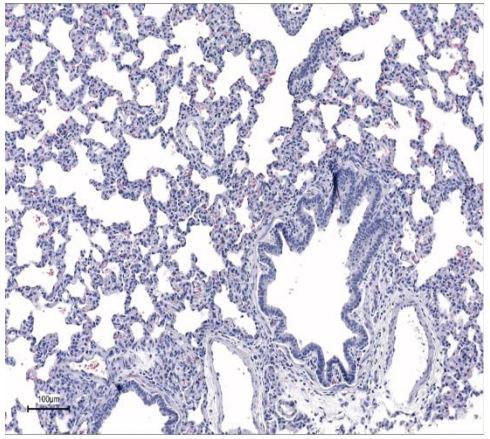
Lung pathologies

Skunk/PEI/2023 **(H5N5)**

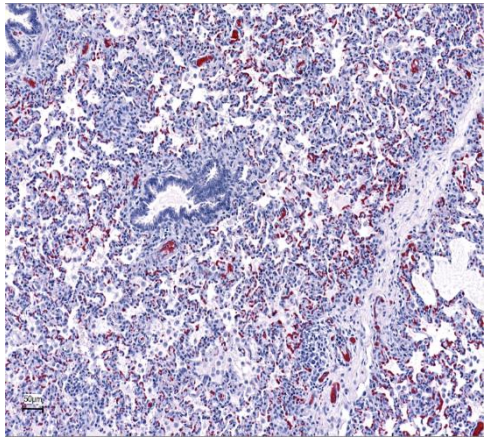


Skunk/AB//2022 **(H5N1)**





Turkey/QC/2023 **(H5N1)**



RT.Hawk/ON/2022 **(H5N1)**

Pneumonic lungs

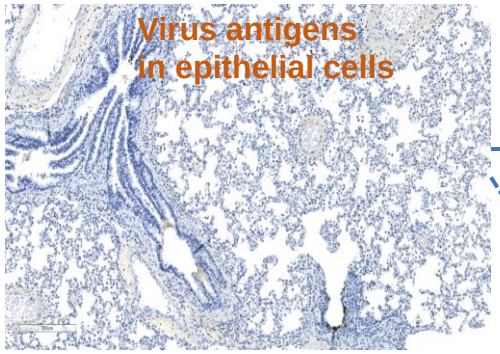
- Focal to diffuse inflammation (three viruses)
- Mononuclear cells/alveolar macrophages infiltrates
- Absent or very mild in the case of Turkey/QC/2023
- Edema (RT.Hawk/ON/2022)

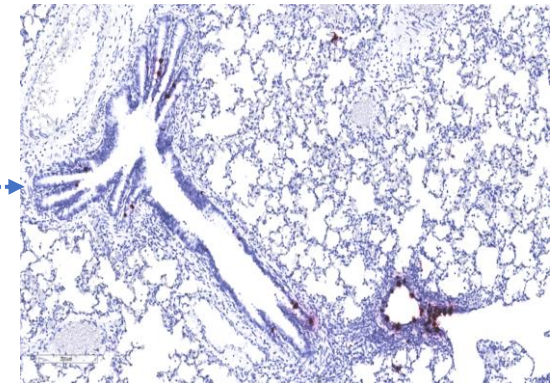
Virus antigen/RNA detection in lun

In

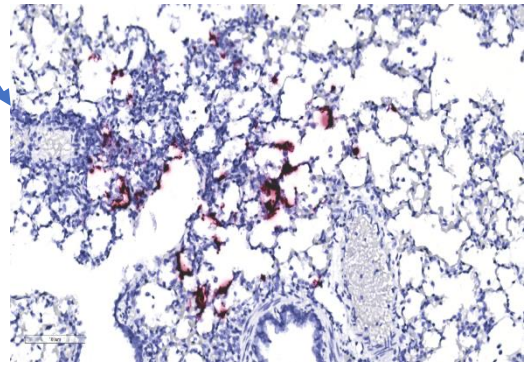
Immunohistochemsitry

Skunk/PEI/2023
H5N5



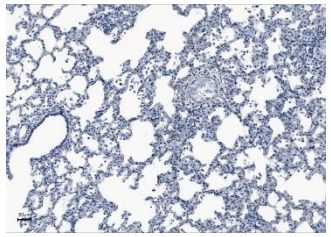


Viral RNA (bronchiolar epithelial cells

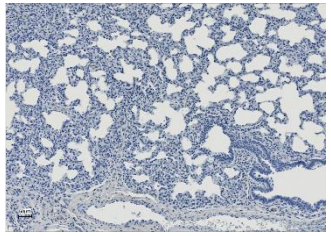


Viral RNA (likely in pneumocytes)

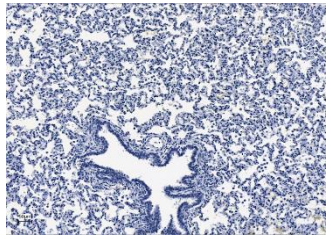
Skunk/AB/2022
H5N1



Turkey/QC/2023
H5N1



RT.Hawk/ON/2022
H5N1



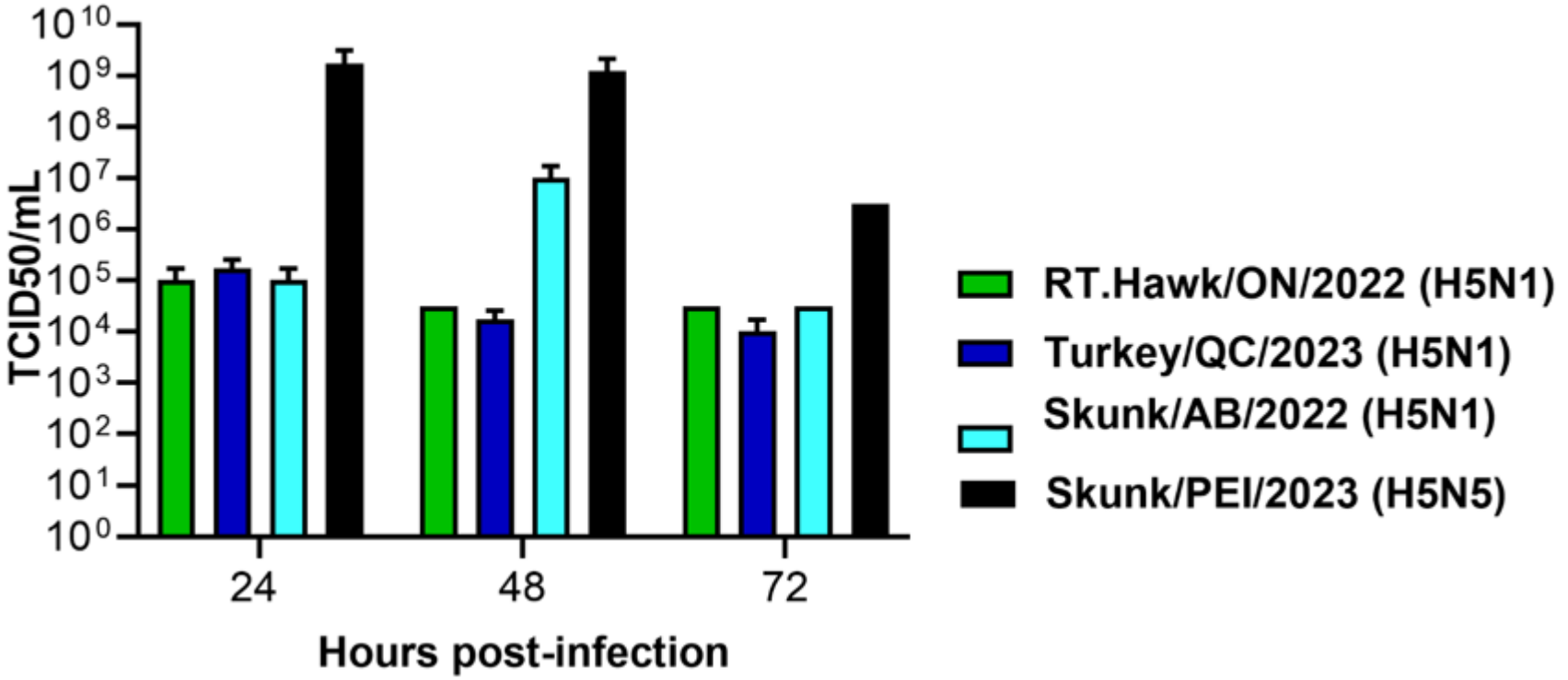
No viral Ags (or few cells stained)

NP-cELISA (post-infection/contact)

	21dpi/20dpc (NP-cELISA)	
	Directly infected pigs	Contact pigs
Skunk/AB/2022 (H5N1)	3/3	2/3
Skunk/PEI/2023 (H5N5)	3/3	0/3
Turkey/QC/2023 (H5N1)	3/3	2/3
RT.Hawk/ON/2022 (H5N1)	3/3	2/3

- All infected and most contact pigs seroconverted.
- Likely, contact transmission

Replication kinetics of HPAI in porcine alveolar macrophages



Immortalized porcine alveolar macrophage cells infected at MOI= 0.02, incubated at 37°C

- **H5N5 replicated to significant titers.**

Seroconversion in wild boars

- Of the **265** sera collected from hunter-killed wild boars in Alberta in 2022, **4** of them were tested positive HPAIv H5N1 antibodies by HI and VNT tests.

- VNT titers ranged from 40-1280

Conclusions

- Domestic pigs are less susceptible to direct HPAIv H5Nx infection
- Possible contact transmission
- Seropositive wild boars show exposure likely due to consumption of sick/dead birds

Future Studies

- Conduct HPAIv H5Nx surveillance using oral fluids in pig farms located at close proximity to poultry farms infected with HPAI
- Continue surveillance of IAV- swine and H5Nx in wild boars in collaboration ECCC
- Continue to conduct risk assessment studies in pigs using newly emerging H5Nx genotypes

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- Continue to conduct risk assessment studies in pigs using newly emerging H5Nx genotypes
- Conduct co-infection H5N1/5 studies in pigs – example – CSF/ASF

Thank you