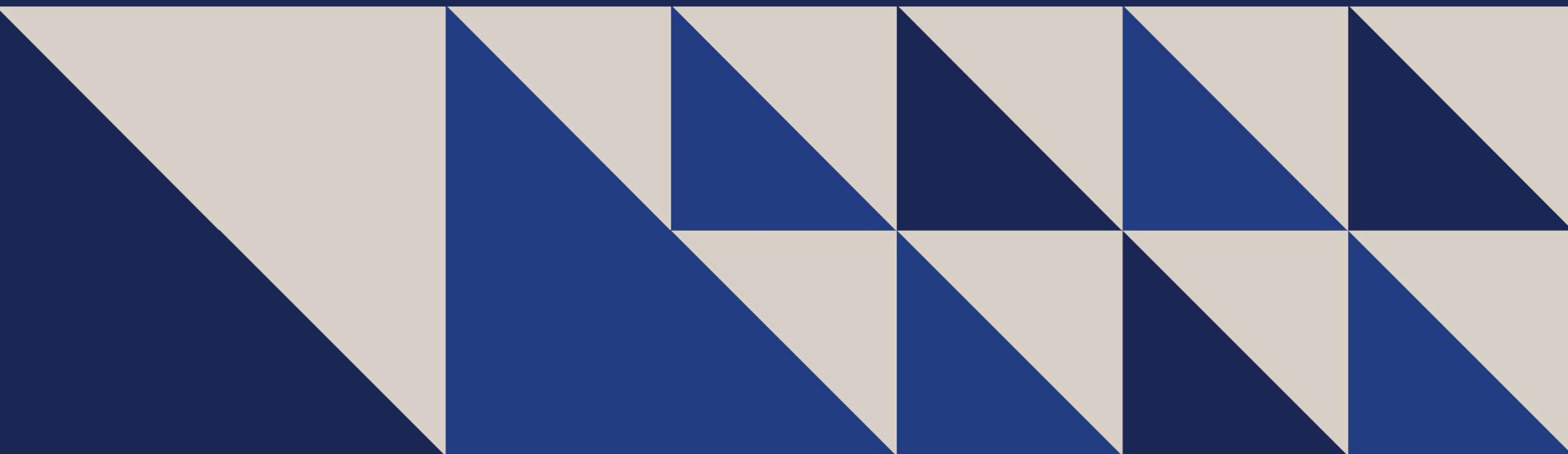


# Ontario Influenza Surveillance and New Emergence 2023

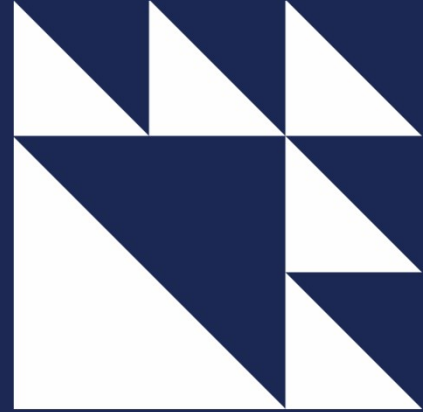
Dr. Kevin Vilaca December 2023



**South West Vets**



# We are a United Family



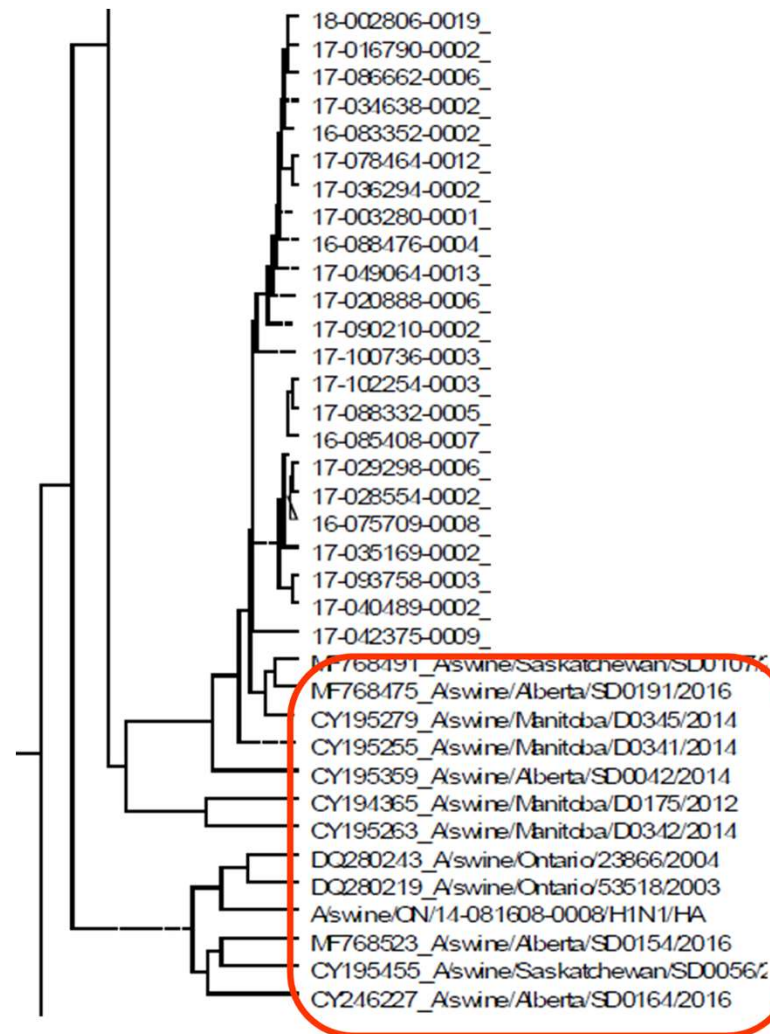
# South West Vets Influenza Surveillance Program



- Passive surveillance since 2016 among our 13 vets and the farms they serve.
- Pigs identified with a new cough – swabs or oral fluids are collected.
- All PCR positive samples are sequenced/added to our influenza database/sent for viral isolation.
- Every virus is compared to the 6 existing regional viruses and outliers are monitored over time.
- Outliers happen, but most times do not spread through the Ontario swine population.
- Emerging clades are considered when updates to the regional vaccine happen.
- Over the years, two significant outliers have been identified and added to the regional vaccine  
2016 – H1N2 and 2020 – H3N2.
- Now in 2023 a third strain is emerging - H3N2.



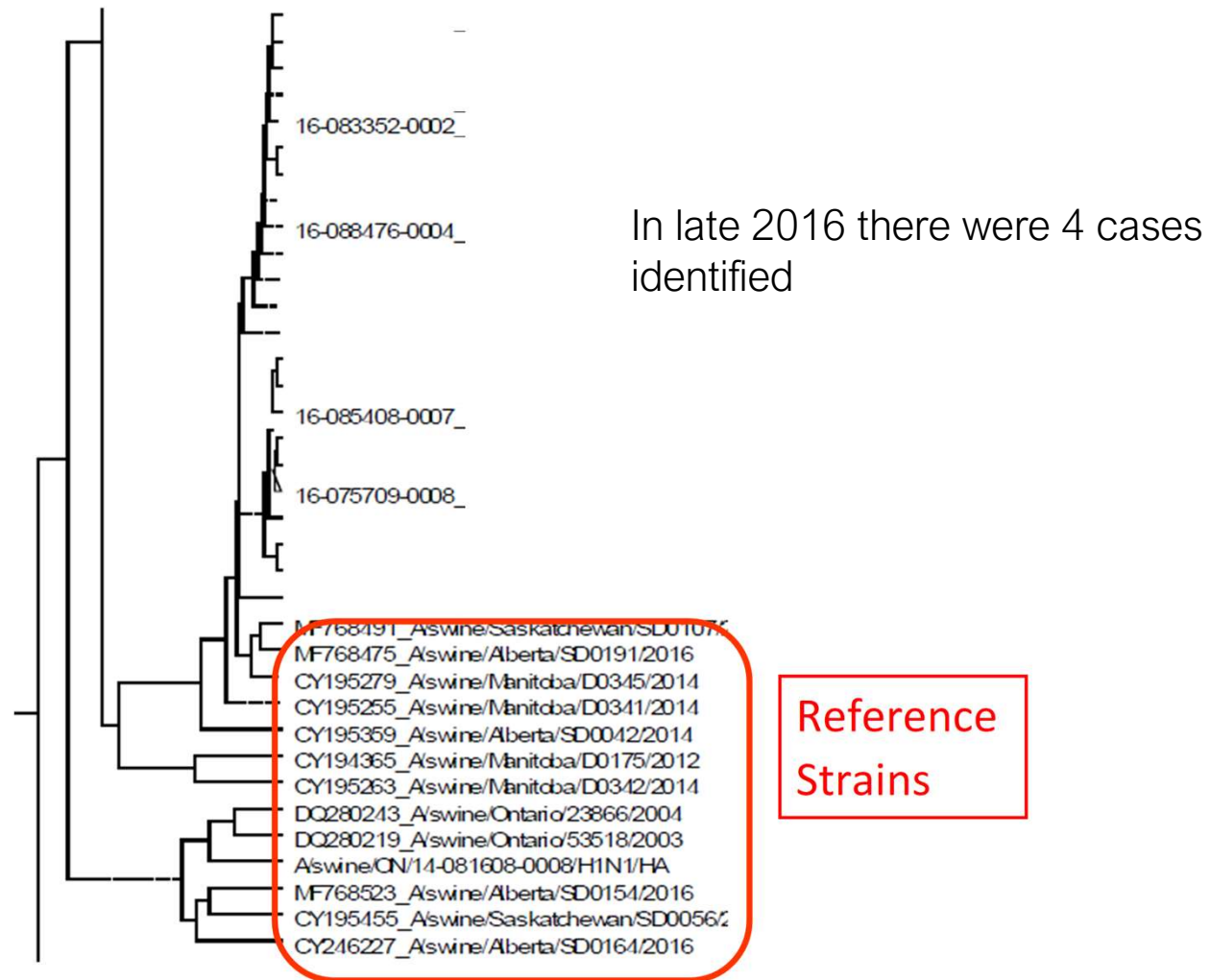
# The 2016 H1N2



Reference  
Strains



# H1N2



# H1N2



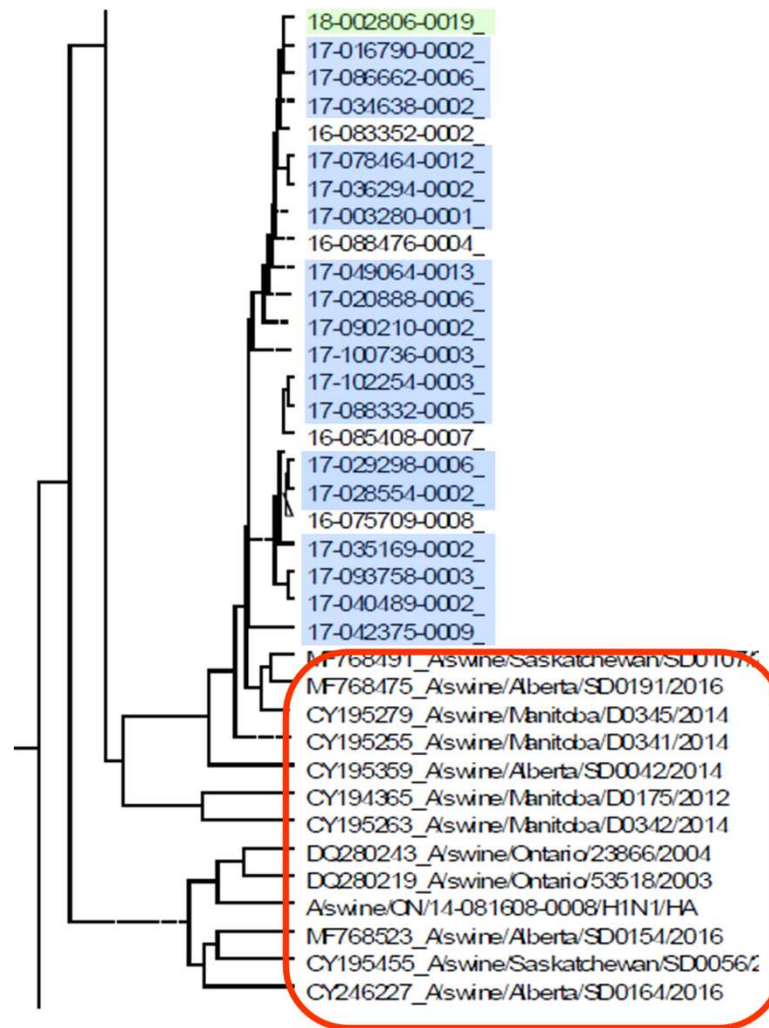
In 2017 there were 18 cases identified.

Reference  
Strains





In 2018,  
H1N2 just  
took off!



Reference  
Strains



## A New H3N2 Virus in 2023

- On April 7<sup>th</sup>, a new H3N2 virus appeared.
- This virus is not similar to any of our current regional strains or to any others in our database.
  - Only 85-86% similar to the current regional H3N2 viruses
  - Only 4 of the 7 sites antigenic sites were similar.

| VIRUS                                 | CLUSTER | 145 | 155 | 156 | 158 | 159 | 189 | 193 |
|---------------------------------------|---------|-----|-----|-----|-----|-----|-----|-----|
| A_swine_SW-20-011479_H3N2_IVnc        | 4       | N   | H   | H   | N   | H   | M   | S   |
| A_swine_PA_A02751501-2023_H3N2_2010.1 | 2010.1  | N   | T   | H   | N   | F   | K   | S   |
| 23-030385-0004_H3N2_EM_               | 4       | N   | T   | H   | N   | F   | K   | S   |





## Over the next few weeks...

Over the next 7 weeks, 12 more cases were reported and sequenced.

Our concerns are:

- **Lack of homology** and agreement in antigenic sites
- **Speed of new cases** appearing
- **Diverse geographical distribution** and lack of connections between herds
- **Severe clinical presentation** – like a naïve introduction
- Genetically similar to a strain circulating in the US.

# Lack of homology and agreement of antigenic sites

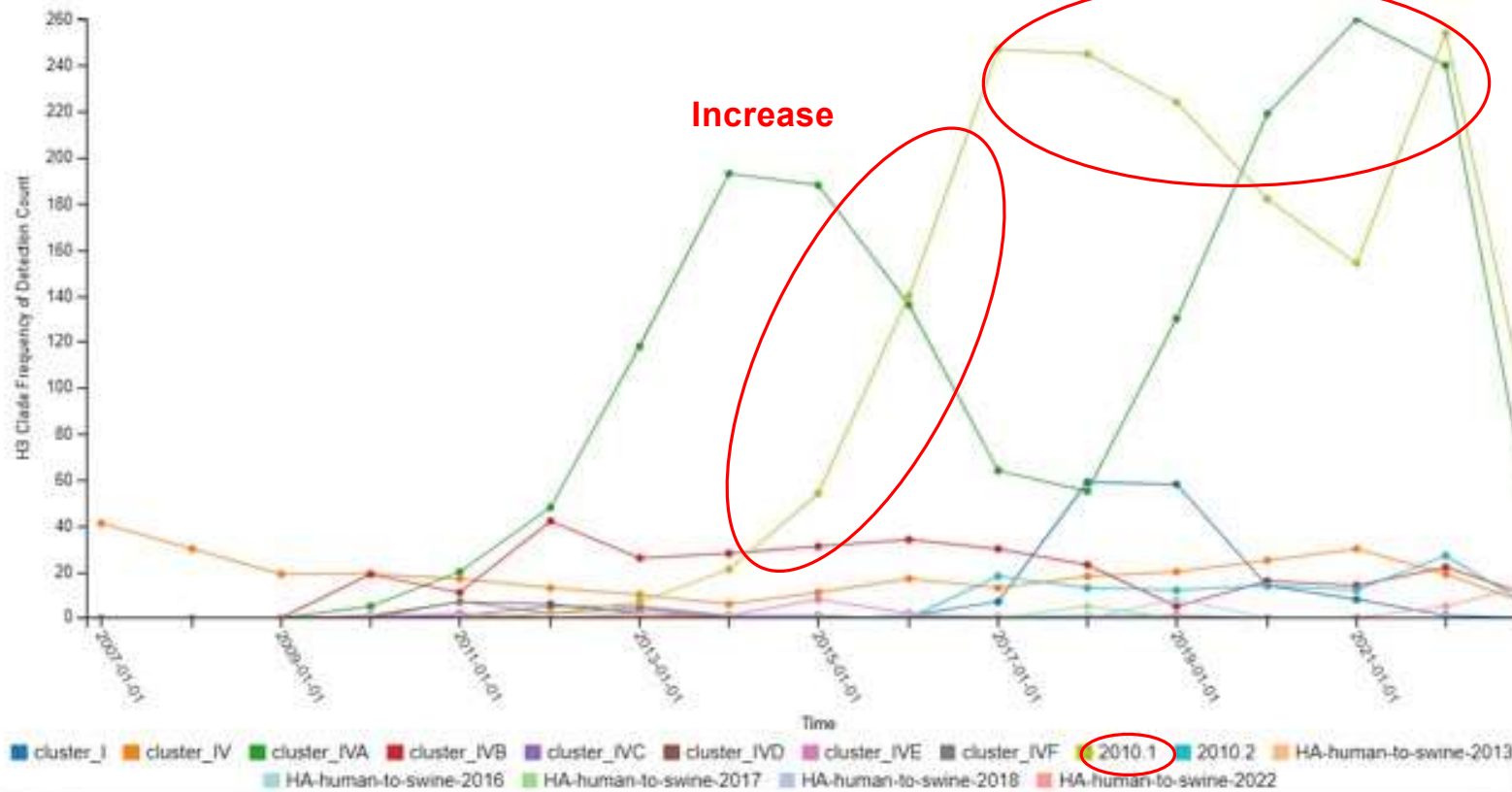
|                         |   |      |      |      |      |      |      |      |      |      |      |
|-------------------------|---|------|------|------|------|------|------|------|------|------|------|
| 23-049177-0006_H3N2_KV_ | ***   | 99.8 | 99.8 | 99.8 | 99.6 | 99.8 | 99.8 | 99.9 | 99.8 | 99.9 | 99.7 |
| 23-046623-0004_H3N2_GW  | 0.2 ***                                     | 99.7 | 99.7 | 99.7 | 99.9 | 99.9 | 99.9 | 99.9 | 99.7 | 99.8 | 99.7 |
| 23-045109-0001_H3N2_GW_ | 0.2 0.3 ***                                 | 99.9 | 99.5 | 99.8 | 99.8 | 99.8 | 99.8 | 99.9 | 99.9 | 99.9 | 99.8 |
| 23-043953-0003_H3N2_CP  | 0.2 0.3 0.1 ***                             | 99.5 | 99.8 | 99.8 | 99.8 | 100  | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 |
| 23-040818-0001_H3N2_CP  | 0.4 0.3 0.5 0.5 ***                         | 99.4 | 99.4 | 99.7 | 99.5 | 99.6 | 99.5 | 99.5 | 99.6 | 99.5 | 99.5 |
| 23-038040-0010_H3N2_CT  | 0.2 0.1 0.2 0.2 0.6 ***                     | 100  | 99.9 | 99.8 | 99.9 | 99.7 | 99.9 | 99.9 | 99.9 | 99.7 | 99.7 |
| 23-037825-0002_H3N2_GA  | 0.2 0.1 0.2 0.2 0.6 0 ***                   | 99.9 | 99.8 | 99.9 | 99.7 | 99.9 | 99.9 | 99.9 | 99.7 | 99.7 | 99.7 |
| 23-036380-0002_H3N2_CP_ | 0.1 0.1 0.2 0.2 0.3 0.1 0.1 ***             | 99.8 | 99.9 | 99.7 | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 |
| 23-036181-0004_H1N2_CP  | 0.2 0.3 0.1 0 0.5 0.2 0.2 0.2 ***           | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 |
| 23-031215-0005_H3N2_CL  | 0.1 0.2 0.1 0.1 0.4 0.1 0.1 0.1 ***         | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 |
| 23-030385-0004_H3N2_EM  | 0.3 0.3 0.2 0.1 0.5 0.3 0.3 0.3 0.1 0.1 *** | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 | 99.9 |

We have not seen such strain preservation and homology **across** herds.

- Only four of the 7 antigenic sites were the same as previous H3N2 strains in Ontario.
- There is a match to a US strain that first appeared in 2013 and became a dominant US strain in 2017.

| VIRUS                                 | CLUSTER | 145 | 155 | 156 | 158 | 159 | 189 | 193 |
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| 23-030385-0004_H3N2_EM_               | 4       | N   | T   | H   | N   | F   | K   | S   |

### H3 Clade Frequency of Detection per Year



US Data  
from  
**ISU **FLU**ture**



Contents lists available at ScienceDirect

Virology

journal homepage: [www.elsevier.com/locate/virology](http://www.elsevier.com/locate/virology)

## Characterization of contemporary 2010.1 H3N2 swine influenza A viruses circulating in United States pigs

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### ARTICLE INFO

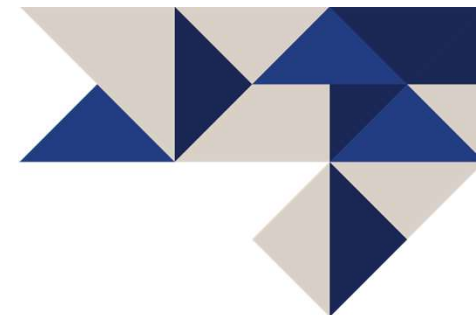
#### Keywords:

Influenza A  
H3N2  
H3N1  
Swine  
H3N2v  
Antigenic motif

### ABSTRACT

In 2012, swine influenza surveillance detected a novel reassorted influenza A virus (IAV) strain containing human-seasonal hemagglutinin (HA) and neuraminidase (NA). Subsequently, these viruses reassorted, maintaining only the human-origin H3, which resulted in a new lineage of viruses that became the most frequently detected H3 clade in US swine (2010.1 HA clade). Here, we assessed the antigenic phenotype, virulence, and transmission characteristics of this virus lineage following its introduction to swine. Relative to 2010.1 viruses from 2012 and 2014, recent 2010.1 contemporary strains from 2015 to 2017 resulted in equivalent macroscopic lung lesions and transmission in pigs. A single mutation at amino acid residue 145 within the previously defined HA antigenic motif was associated with a change of antigenic phenotype, potentially impairing vaccine efficacy. Contemporary 2010.1 viruses circulating in swine since 2012 were significantly different from both pre-2012H3N2 in swine and human-seasonal H3N2 viruses and demonstrated continued evolution within the lineage.

## What is the Ontario picture in 2023!



| Subtype | Cluster | Count |
|---------|---------|-------|
| H1N1    | alpha   | 1     |
|         | beta    | 2     |
|         | gamma   | 3     |
|         | pdm     | 7     |
| H1N2    | alpha   | 24    |
| H3N2    | 2010.1  | 46    |
|         | IV      | 18    |
|         | IVb     | 6     |
|         | IVx1    | 2     |
|         | IVx2    | 4     |

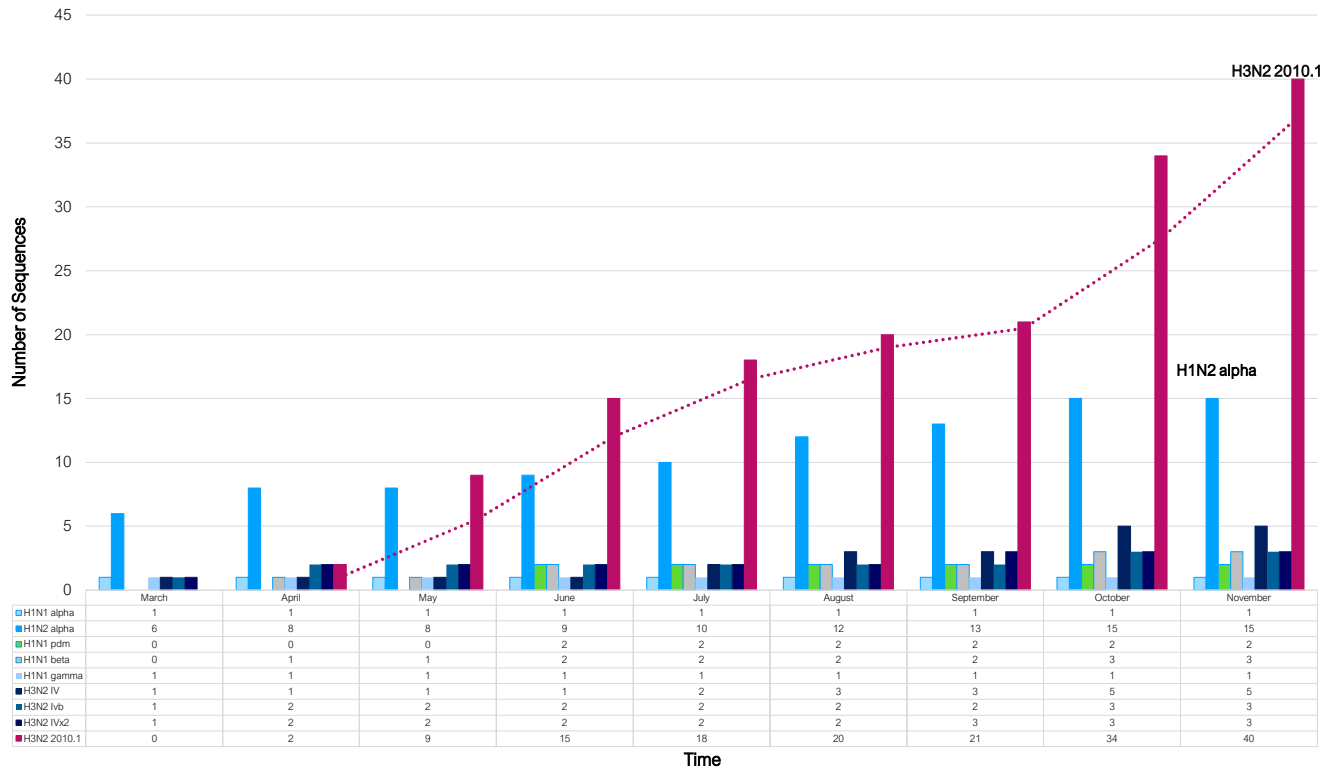
Dr. Ojkic AHL – Jan 2023 to present

- 111 Influenza cases total
- 41% of all isolates are this strain
- Of H3s (76), 61% are this cluster

# Speed of new cases appearing



Cumulative Sequencing Data March - November 2023



We went from:

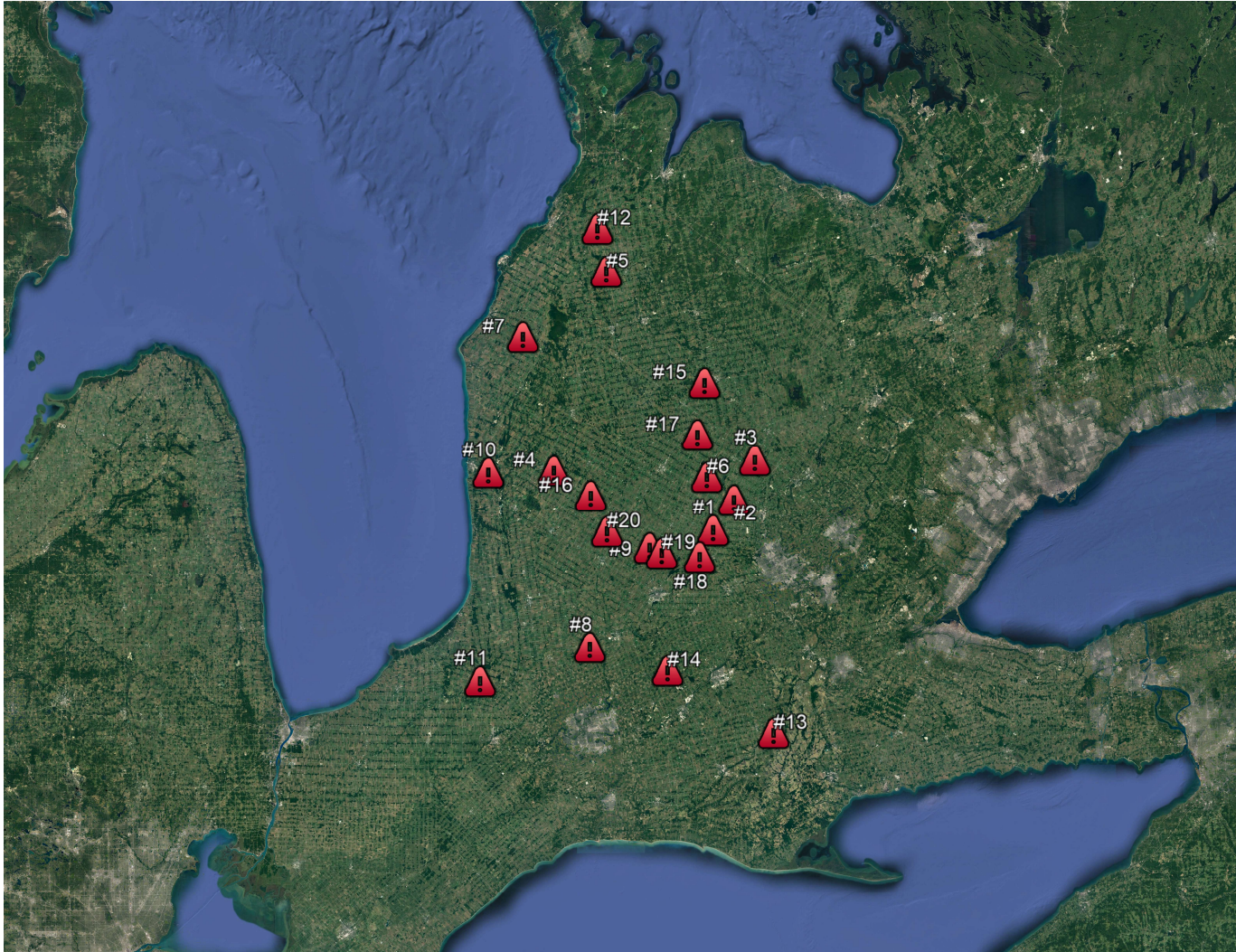
- **2 cases in April**
- to **12 cases in June**
- with more pending sequences, this rate of increase in the summer has never been seen before.

## **Clinical presentation = severe, like a naïve introduction**

- Herds describe a sudden onset of coughing across all stages of production.
- Sows off feed, high fevers and some abortions.
- Previous vaccination did not have an influence.
- In growing pigs, a sudden onset of coughing and off feed, followed by increase in mortality due to bacterial pneumonia.
- Increased use of antibiotics to control mortality due to pneumonia.








## Diverse Geographical Distribution

# What do we do with all this information?

We are at the start of a new outbreak!

- SW surveillance program provided early detection and warning.
  - I believe we are on the cusp of an influenza outbreak with a new strain from the US.
  - Have not seen a **virus move** this **quickly**, especially during the warmer and drier months of the year.
  - Given how this virus performed in the US, we anticipate it will only increase and will **become a dominant strain in Ontario**.
  - Given the clinical presentation in Ontario herds, **there is no herd immunity or protection against this strain**.
  - We are **concerned** what will happen during flu season (fall and winter) when influenza is most active and problematic.
  - Veterinarians and government have an opportunity to be proactive and preventative.
  - If we act now, we can limit the spread of disease and impact on Canadian herds, while we still have warmer weather on our side.
- 

# June Meeting with CFIA:

## Concurrent Vaccine Development



- Update the 6 way South West Vets Regional vaccine with the emerging strain as we have done in the past, complete with an immunogenicity trial.
- The new 6-way vaccine will be available to industry Jan 2024 and continue to protect against circulating strains in Ontario.



- Due to special circumstances, concurrently develop an Emergency Monovalent H3N2 vaccine that can be available to protect the industry ahead of the fall influenza season (Sept 2023).
- At the same time do immunogenicity studies and report results to CFIA-CCVB.
- Continue to be preventative and proactive with influenza control and have baseline herd immunity before fall influenza season.

# Early Emergency Monovalent Vaccine Use



- Emergency Vaccine Trial in Pregnant Inventory.
  - Pregnant sow at various parities and stages of production were vaccinated.
  - Rectal temperatures monitored daily and no spike seen.
  - No other adverse reactions observed.
- Antigenicity Trial to confirm immune response.
- Field experience
  - Over 100,000 doses used in sows and gilts and no adverse reaction observed.

**Goal is to get as much of the sow inventory vaccinated and immune before the fall weather kicks in and influenza starts really moving around.**

## What do the next few months hold for IAV in Ontario?

- The surveillance system worked for early detection of an emerging strain.
- We are on the cusp of an outbreak.
- Monovalent and regional vaccine have proven safe and effective tools that offer protective immunity and will help to mitigate this possible outbreak.

**Putting it all together will allow us to be preventative and proactive when it comes to IAV control. This is a great news story!**





## Special Thanks



- CFIA-CCVB – for your understanding and support of the need for a novel approach
- U of G and AHL – Dr. Davor Ojkic
- OMAFRA – for being so progressive and seeing the need for SIV sequencing
- The vets and staff at South West Vets
- The Flu team – Ken, Lori, Guy, Courtney, Jordan and Andreanna