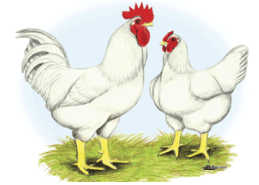


*Epidemiological study of viral  
and bacterial pathogens in  
Ontario broiler chickens*



Hind Kasab-Bachi, Eric Nham, Michael Eregae  
Department of Population Medicine, University of Guelph

# Outline



- ▣ Background (Hind)
- ▣ Study design (Eric)
- ▣ Data Analysis & Preliminary Results (Michael)
- ▣ Way Forward (Michael)
- ▣ Questions (all)



# Background

# Poultry Industry & Enhanced Surveillance Project (ESP)



- In 2009, poultry products produced in Canada were valued at **\$3 billion** (Agriculture and Agri-Food Canada)
- Chicken industry provides 49,700 jobs; **contributes \$9.5 billion to Canadian economy** (CFC, 2010)
- Baseline surveillance in the broiler industry has not been conducted in Canada
- ESP- cross-sectional baseline surveillance study

# ESP Objectives



1. Prevalence of 13 pathogens
2. Effects of current, recommended biosecurity and management practices on pathogen presence
3. Economic impact of pathogens on health and production
4. Antimicrobial use and antimicrobial resistance in *Clostridium difficile* and *Clostridium perfringens*

## PATHOGENS OF INTEREST

<u>Viruses</u>	<u>Bacteria</u>
<b>Avian Encephalomyelitis Virus (AEV)</b>	<i>Clostridium difficile</i>
<b>Chicken Anemia Virus (CAV)</b>	<i>Clostridium perfringens</i>
<b>Fowl Adenovirus (FAdV)</b>	<i>Brachyspira</i> spp.
<b>Infectious Bursal Disease Virus (IBDV)</b>	<i>Enterococcus cecorum</i>
<b>Reovirus (REO)</b>	
<b>Avian Adeno-Associated Virus (AAAV)</b>	
Infectious Bronchitis Virus (IBV)	
Infectious Laryngotracheitis Virus (ILTIV)	
Newcastle Disease Virus (NDV)	

# Avian Encephalomyelitis Virus (AEV)



- Causes encephalomyelitis in young chickens (Pattison *et al.*, 2008)
- Clinical signs include paralysis, ataxia, muscular dystrophy, muscular dystrophy, depression, tremors (Pattison *et al.*, 2008, Saif *et al.*, 2008)
- Morbidity ranges from 15% to 16% (Saif *et al.*, 2008)
- Mortality ranges from 25% to 50% (Saif *et al.*, 2008)

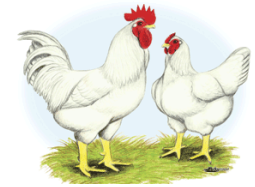
# Chicken Infectious Anemia Virus (CAV)



- It causes anemia disease in young chickens (Schat *et al.*, 2004)
- Clinical signs: atrophy of the thymus, spleen and bursa of Fabricius (Pattison *et al.*, 2008), bone marrow aplasia (Goryo *et al.*, 1982), anemia (Goodwin *et al.*, 1992), and immune suppression (bounous *et al.*, 1995)
- Causes high condemnations at slaughter plants (Hagood *et al.*, 2000)
- Disease morbidity varies from 20% - 60% (McNulty *et al.*, 1991); mortality of 1% - 5% (Hoop *et al.*, 1992)

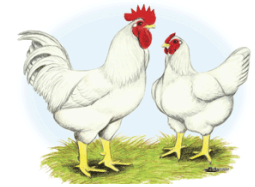


# Fowl Adenovirus (FAdV)



- Causative agent of Inclusion body hepatitis (IBH)
- Clinical signs include ruffled feathers, stooping, sudden death, low weight gain (Saif *et al.*, 2008, Hess *et al.*, 1999)
- Mortality between 5% and 10%, but can be > 30% during outbreaks (Ojkic *et al.*, 2008b)
- The financial loss to the Ontario broiler industry due to IBH is approximately \$300,000 gross value of finished live weight lost (Dr. Rachel Ouckama, personal communication)

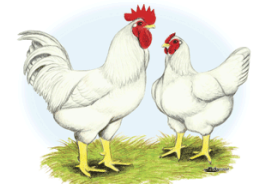
# Infectious Bursal Disease Virus



[en.engormix.com](http://en.engormix.com)

- Causes Gumboro disease
- Clinical signs: Vent picking, soiled vent, watery diarrhea, anorexia, depression, ruffled feathers, trembling, severed prostration, dehydration, and hypothermia (Cosgrove et al., 1962)
- Morbidity rate of up to 100% in susceptible flocks; mortality 1% - 50%; (Saif et al., 2008; Kataria et al., 2006)

# Reovirus (REO)



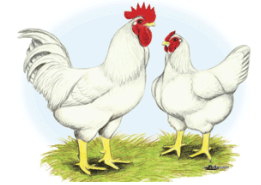
- Primary cause of viral arthritis/tenosynovitis
- Clinical signs: lameness, and swollen hock joint (s) (Pattison et al., 2008)
- Economic losses due to excessive culling, lameness, and reduced weight gain

# *Clostridium difficile*



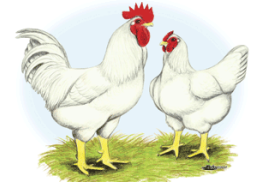
- Only zoonotic pathogen in the study
- Major cause of antibiotic-associated diarrhea and colitis in humans
- A study conducted on the occurrence *C. difficile* in live broiler chickens sold in Zimbabwe market places found 29% prevalence of *C. difficile* in fecal droppings (Simango and Mwakurudza, 2008)
- Antimicrobial testing showed isolates were susceptible to metronidazole and vancomycin (Simango and Mwakurudza, 2008)

# *Clostridium perfringens*



- Main cause of necrotic enteritis (NE)
- Mortality ranges between 2% and 10% (Hafez, World Poultry)
- Subclinical form: decreased digestion and nutrition absorption, reduced weight, and increased feed conversion ratio
- Clinical form: high mortality
- Annual loss in the world's broiler industry is estimated to be **\$2 billion** (Van der Slijs, 2000)

# *Brachyspira* spp.



- Known cause of avian intestinal spirochetosis (AIS) (Hampson et al., 2001)
- Primarily been a problem of laying hens, but has recently been reported to cause clinical signs in broiler chickens

# *Enterococcus cecorum*

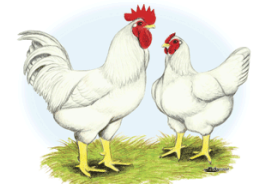


- The bacterium is among normal gut flora of chickens and other domestic animals (Devriese et al., 1991)
- Causes bone and joint lesions in broilers resulting in lameness, paralysis, death, or condemnations at slaughter (Herdt et al., 2009)

# Study Design



# Study Design



- **Sampling frame**

- Producers contracted to 6 processing plants
- 70% of Ontario broiler processing



- **Sampling units**

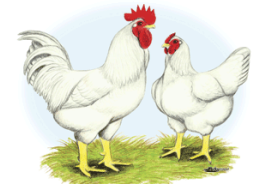


- **Sample collection**



- **Producer interview**

# Study Design



- **Sampling frame**



- **Sampling units**

- n= 240 flocks
- randomized selection of flocks
- proportional selection of processing plants



- **Sample collection**



- **Producer interview**

# Study Design



- **Sampling frame**



- **Sampling units**



- **Sample collection**

- 15 pooled blood samples
- 15 whole intestines
- 3 pools of 5 cloacal swabs from 15 birds



- **Producer interview**

## PROCESSING AT AHL

- 3 pools of 5 cecal tonsils
- 5 pools of 3 cecal tissue
- 5 pools of 3 cecal swabs
- 5 pools of 3 cecal and colon swabs

# Processing Cecal Tonsils



# Study Design



□ **Sampling frame**



□ **Sampling units**



□ **Sample collection**



□ **Producer interview**

- Face to face interview 2 to 3 days after flock processing
- Farm management, biosecurity practices, and AMU

# Data Analysis & Preliminary Results

## SAMPLE ANALYSIS

<b>Virus</b>	<b>Samples Type</b>	<b>Laboratory Test</b>
<b>AEV</b>	Serum	ELISA
<b>CAV</b>	Cloacal swabs, serum	PCR, ELISA
<b>FAdV</b>	Cloacal swabs, cecal tonsils, serum	Virus isolation in eggs and cells, AGID
<b>IBDV</b>	Cloacal swabs, cecal tonsils, serum	Virus isolation in cells, PCR, ELISA
<b>REO</b>	Cloacal swabs, cecal tonsils, serum	Virus isolation in cells and eggs, PCR, ELISA
<b>AAAV</b>	FAdV positive cultures	PCR

## PROCESSING/ SAMPLE ANALYSIS

Bacteria	Sample Type	Laboratory Test
<i>Clostridium difficile</i>	Colon/cecal swabs	Bacterial culture, ELISA, Minimum Inhibitory Concentration (MIC)
<i>Clostridium perfringens</i>	Cecal swabs	Bacterial culture, PCR (genotyping), MIC
<i>Brachyspira</i> spp.	Cecal tissue	PCR, PCR speciation
<i>Enterococcus cecorum</i>	Cecal swabs	Bacteria culture



# Data Analysis

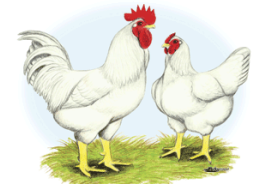


1. **Identification of risk factors:** multivariable logistic regression
2. **Economic Impact:** to be determined in consultation with collaborators in Department of Food, Agricultural & Resource Economics (FARE)

For example:

- Results from prevalence and risk factor (feed/biosecurity and management practices) analysis will be used in economic analyses

# Preliminary Results



- 121 samples out of 240 collected; the same number of interviews conducted
- For FAdV, 78.4% of 51 tested flocks were positive on agar gel immunodiffusion
- Virus isolation in eggs for FAdV and REO was negative (n =49)
- No laboratory results available for IBDV, CAV, AAVV, or AEV
- 95%, 82%, 1%, 0% of 98 flocks tested positive for *E. cecorum* , *C. perfringens*, *C. difficile*, *brachyspira*, respectively



# Way Forward

# Way Forward



- Data collection is ongoing until November 2011
- This research will contribute to the design of future broiler disease control programs in the Ontario

# Acknowledgement



## **Advisor**

Michele Guerin

## **Committee Members**

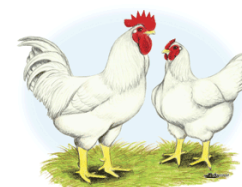
Scott McEwen, Cate Dewey, Davor Ojkic, David Pearl, Andreas Beocker, Durda Slavic

## **Project Funding/Personal Funding**

OMAFRA- UofG Partnership, Animal Health Laboratory, Poultry Industry Council, MSc. OVC Fellowship, OMAFRA- HQP

## **Collaborators**

Chicken Farmers of Ontario, Slaughter Plants, Animal Health Laboratory, Producers, Enhanced Surveillance Team



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**Thank you for your attention!**