Scenario Tree Model - Canadian Notifiable Avian Influenza Surveillance System

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Outline

- Scenario tree model – scale
- Canadian Notifiable Avian Influenza Surveillance (CanNAISS) scenario tree model
  - Standardized presentation
  - Results
  - Planning tool
Scenario tree (freedom) model

Probability of Freedom

Biosecurity

Recent testing activity involving many animals

Recent testing activities involving few animals

Evidence Supporting Freedom

Historical testing activities

Weight = Time
Number of animals sampled
Accuracy of the test

Probability of introduction
Standardized presentation of scenario tree models*

- **(1) definitions to describe the objective of the model**
  - Design prevalence, time period, case definition, population

- **(2) initial time period**
  - Start date (1\textsuperscript{st} time period) & prior probability of infection

- **(3) input parameters**
  - Values and distribution of probability of introduction, diagnostic test sensitivities, relative risks etc.

*Vanderstichel, Christensen, Stryhn, Hurnik. 2013. Standards for reporting surveillance information in freedom from infection models by example of Trichinella in Canadian market hogs. PVM (Accepted March 2013).
Standardized presentation of scenario tree models* (Con’t)

- (4) data
  - Actual data

- (5) model settings & structure
  - Scenario, software, number of simulations etc.

- (6) outputs
  - Probability of freedom and if relevant system sensitivity

- (7) validation
  - Biological specification & technical specification

*Vanderstichel, Christensen, Stryhn, Hurnik. 2013. Standards for reporting surveillance information in freedom from infection models by example of Trichinella in Canadian market hogs. PVM (Accepted March 2013).
Standardized presentation of the CanNAISS scenario tree model*

(1) definitions to describe the objective of the model

- Design prevalence, time period, case definition, population
  - the design prevalences (DP) were 1% farms and 30% poultry in infected farms
  - the time period (TP) was 1 month
  - the case definition was detection of NAI virus (isolation or PCR)
  - the target populations were: 685, 2,050, and 2,433 poultry farms for BC Ontario and East & West respectively;

Standardized presentation of the CanNAISS scenario tree model*

- **(2) initial time period**
  - Start date (1st time period) & prior probability of infection
    - The 1\textsuperscript{st} time period was August 2008
    - The prior probabilities of infection (at the start of August 2008 and after an outbreak had been resolved) was \texttt{pert(0.49,0.5,0.51)};

Standardized presentation of the CanNAISS scenario tree model*

3 input parameters

- Values and distribution of probability of introduction, diagnostic test sensitivities
  - The probability of introduction was pert (0.067, 0.083, 0.1) scaled to the subpopulations: BC, ON, East&West;
  - Diagnostic test sensitivities (se) were
    - seVI= pert(0.800, 0.905, 0.990);
    - sePCR= pert(0.750, 0.839, 0.950);
    - seELISA= pert(0.720, 0.889, 0.999);
    - seAGID= pert(0.400, 0.778, 0.999); and
    - seHI=pert(0.800, 0.905, 0.999);

Standardized presentation of the CanNAISSL scenario tree model*

- **(4) data**
  - The study period was August 2008 to December 2011
  - The number of farms tested were
    - BC: 556
    - Ontario: 654
    - East & West: 1,121
  - Diagnosis at submission level
  - Inherent hierarchical data structure
    - Tests, samples, submission, herd, month

The submission diagnosis was 10 samples negative for NAI:

Data  
8 samples negative on ELISA  
2 samples negative on ELISA/HI testing

Laboratory result:  
Antibodies against H3
## Hierarchical structure

### Subpopulation (BC, ON, East & West)

### Month (data)

<table>
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<th>nVI</th>
<th>nPCR</th>
<th>nELISA</th>
<th>nAGID</th>
<th>nHI</th>
<th>nHIa</th>
<th>nAIV</th>
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</tr>
</tbody>
</table>

E.g. VENAIS

Test protocol:  
- ELISA  
- ELISA/HI  
- AGID/HI  
- Etc.
Standardized presentation of the CanNAISS scenario tree model*

- **(5) model settings & structure**

  - Scenario tree, software, number of simulations etc.
  
    - model setting: stochastic 1 000 iterations in Excel with PopTools as an add-on;
  
    - scenario tree

Farm Status

Unit Status

Protocol

Standardized presentation of the CanNAISS scenario tree model*

- **(6) outputs**
  - Probability of freedom
    - graphical presentations of the posterior probability of each subpopulation being free from NAI at the level of the DP

- **(7) validation**
  - Biological specification
    - Sensitivity analysis
    - Peer review process*

* At 1% farm prevalence and 30% within farm prevalence
CanNAISS tool
FY 2012-2013 forecast*

Posterior probability of being free / Probabilité postérieure d'être indemne

* Preliminary data 31 August 2012
Claim of freedom from NAI in Canada

- CanNAISS scenario tree model
- Many testing protocols
- Context (reports)