

Sensitivity of surveillance programs in vaccinated poultry populations

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Purpose of vaccination, defines the surveillance target output



EMERGENCY VACCINATION

Early detection: before
farm-to-farm transmission



PREVENTIVE VACCINATION

Maintain and prove freedom

Key practical surveillance questions

Who to sample?

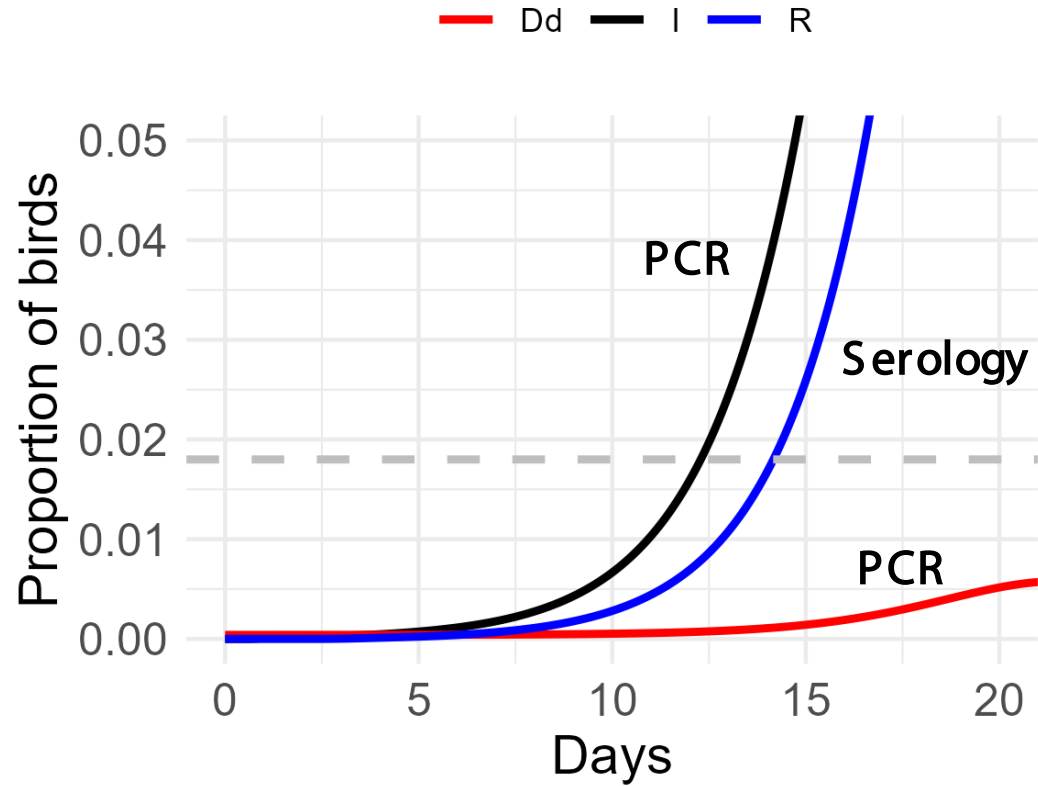
What to sample?

How many samples?

When and how often?

SENSITIVITY

Who and What?



How many and when?

We need assumptions (hypothesis)
regardless of the design method we use

PREVENTIVE VACCINATION
Maintain and prove freedom



Design prevalence

EMERGENCY VACCINATION
Early detect before transmission



"Design" R_h

Emergency Vaccination

Early Detection




Preventive Veterinary Medicine

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Risk based surveillance for early detection of low pathogenic avian influenza outbreaks in layer chickens

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A.A. de Koeijer ^a 

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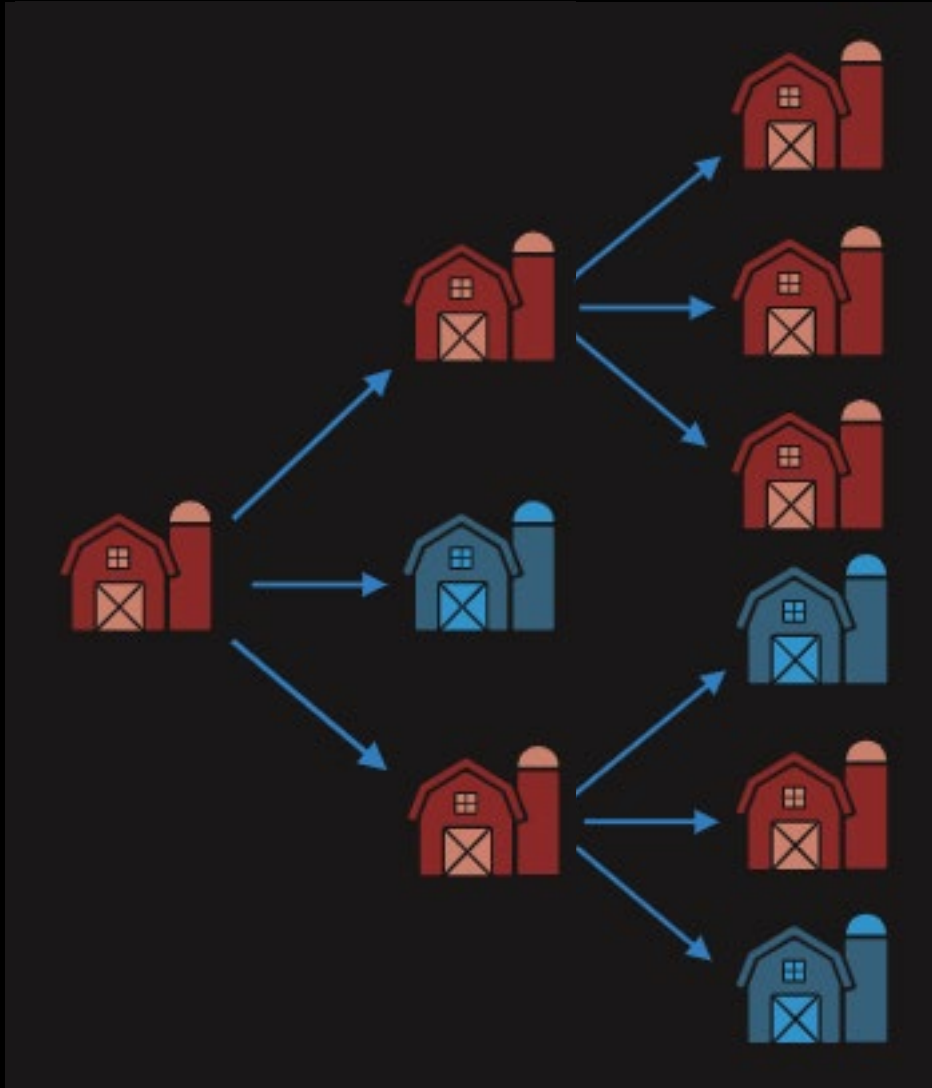
SCIENTIFIC OPINION



Vaccination of poultry against highly pathogenic avian influenza – Part 2. Surveillance and mitigation measures

EFSA Panel on Animal Health and Animal Welfare (AHAW) | European Union Reference Laboratory for Avian Influenza | Søren Saxmose Nielsen | Julio Alvarez | Dominique Joseph Bicout | Paolo Calistri | Elisabetta Canali | Julian Ashley Drewe | Bruno Garin-Bastuji | Christian Gortázar | Mette S. Herskin | Virginie Michel | Miguel Ángel Miranda Chueca | Barbara Padalino | Helen Clare Roberts | Hans Spoolder | Karl Stahl | Antonio Velarde | Arvo Viltrop | Christoph Winckler | Alessio Bortolami | Claire Guinat | Timm Harder | Arjan Stegeman | Calogero Terregino | Barbara Lanfranchi | Ludovica Preite | Inma Aznar | Alessandro Broglia | Francesca Baldinelli | Jose Luis Gonzales Rojas

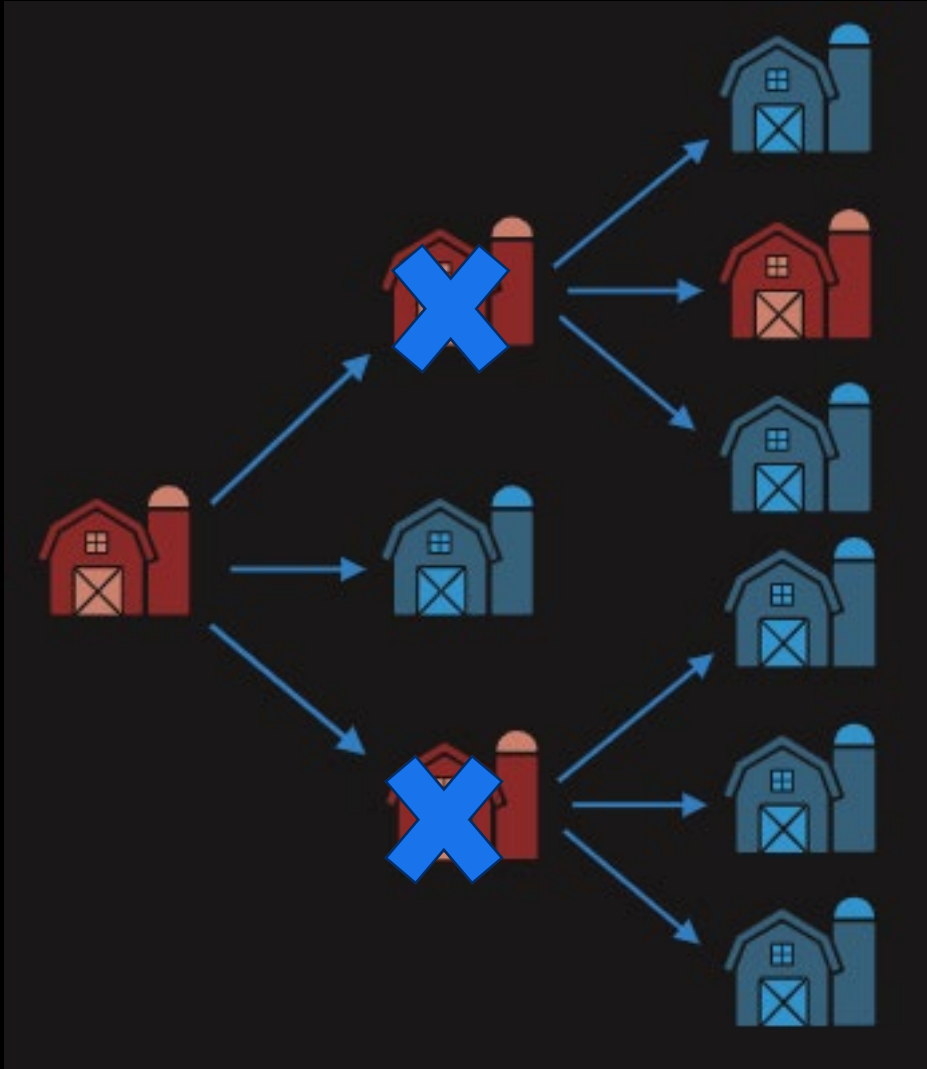
Design R_h



$$R_h = 2$$

Farm dense areas where there is high risk of major epidemics

Early detection - > detect before transmission



$$R_h < 1$$

Stop transmission by reduction of infectiousness of a flock

Depends on:

Transmission dynamics

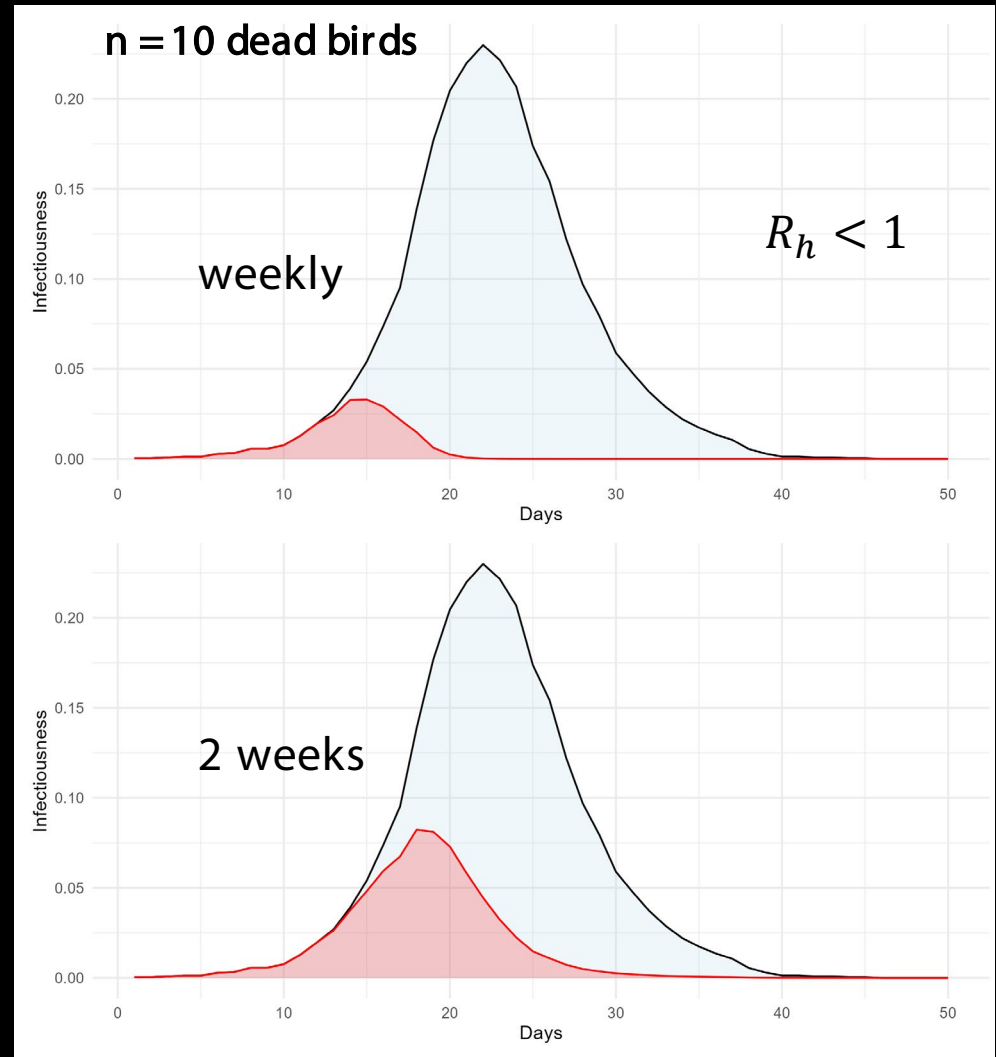
Prevalence in time

Sample size

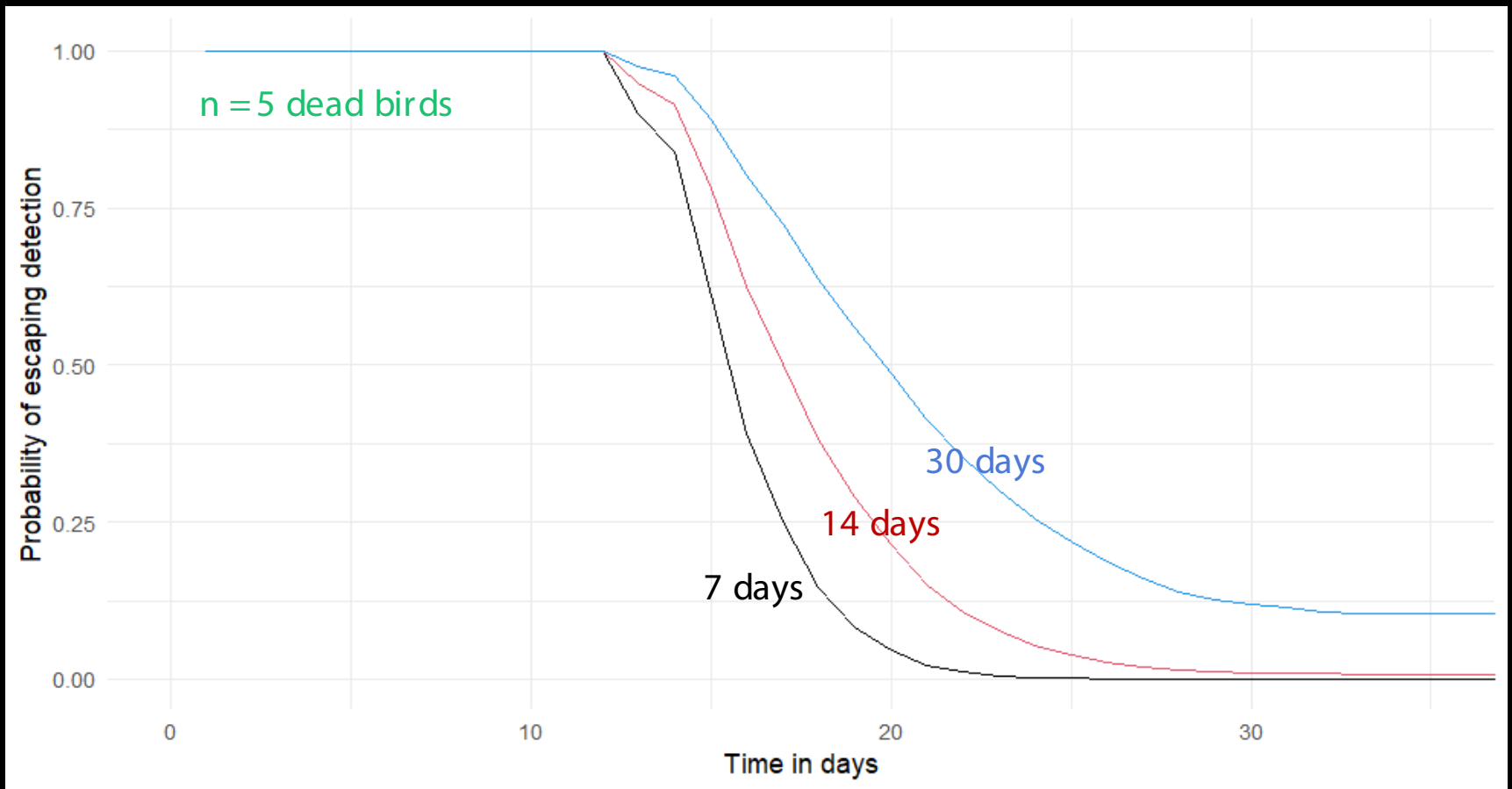
Sampling frequency

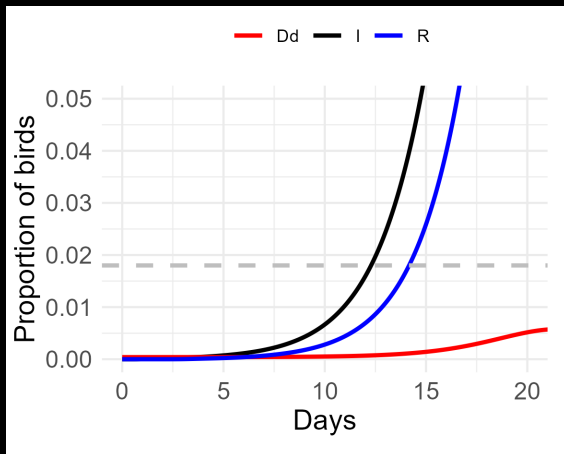
Se diagnostic test

Confidence



Confidence - \rightarrow 1 - Probability of scaping detection





Early detection of vaccinated infected duck flocks

Birds (test)	Samples size	Sampling interval (days)	Percent outbreaks where confidence >99%	Days post introduction when detection takes place	<i>R</i>
Passive reporting				21 (17 - 30)	1.8
Dead ducks (qPCR)	≤ 5	7	95%	15 (11 - 24)	0.4 (0.3 - 0.5)
Life ducks (qPCR)	60	14	97%	14 (11 - 23)	0.3 (0.3 - 0.4)
Life (Serology)	60	14	97%	14 (11 - 24)	0.4 (0.3 - 0.5)

Preventive Vaccination

Confidence
in
freedom





Preventive Veterinary Medicine

Volume 79, Issues 2–4, 16 May 2007, Pages 71–97



Demonstrating freedom from disease using multiple complex data sources: 1: A new methodology based on scenario trees

P.A.J. Martin ^{a c}  , A.R. Cameron ^{b c}, M. Greiner ^{c 1}

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ORIGINAL ARTICLE

Transboundary and Emerging Diseases WILEY

Quantification of the sensitivity of early detection surveillance

A. R. Cameron  | A. Meyer  | C. Faverjon  | C. Mackenzie 

Scenario tree model -> Surveillance Se

All farms/flocks sampled

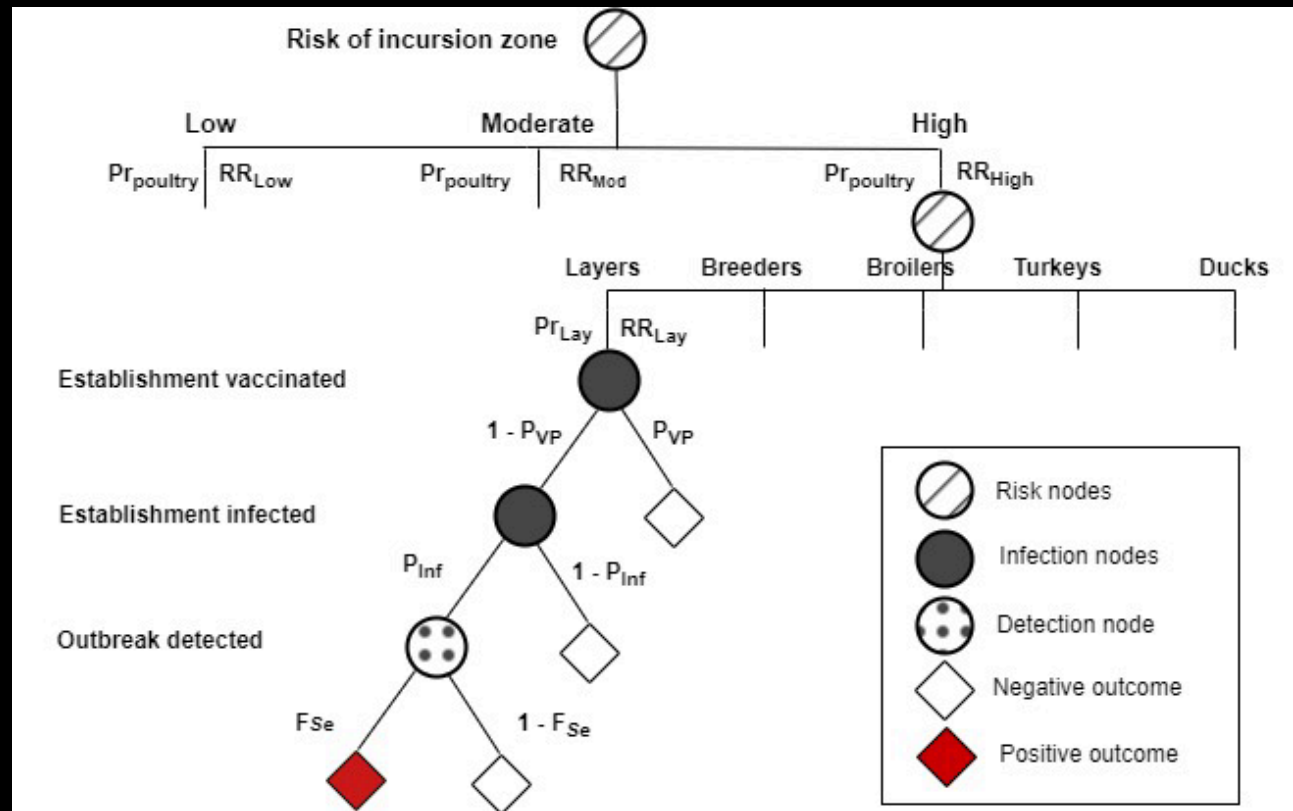
At flock level:

Sample size -> F_{Se}

Design prevalence

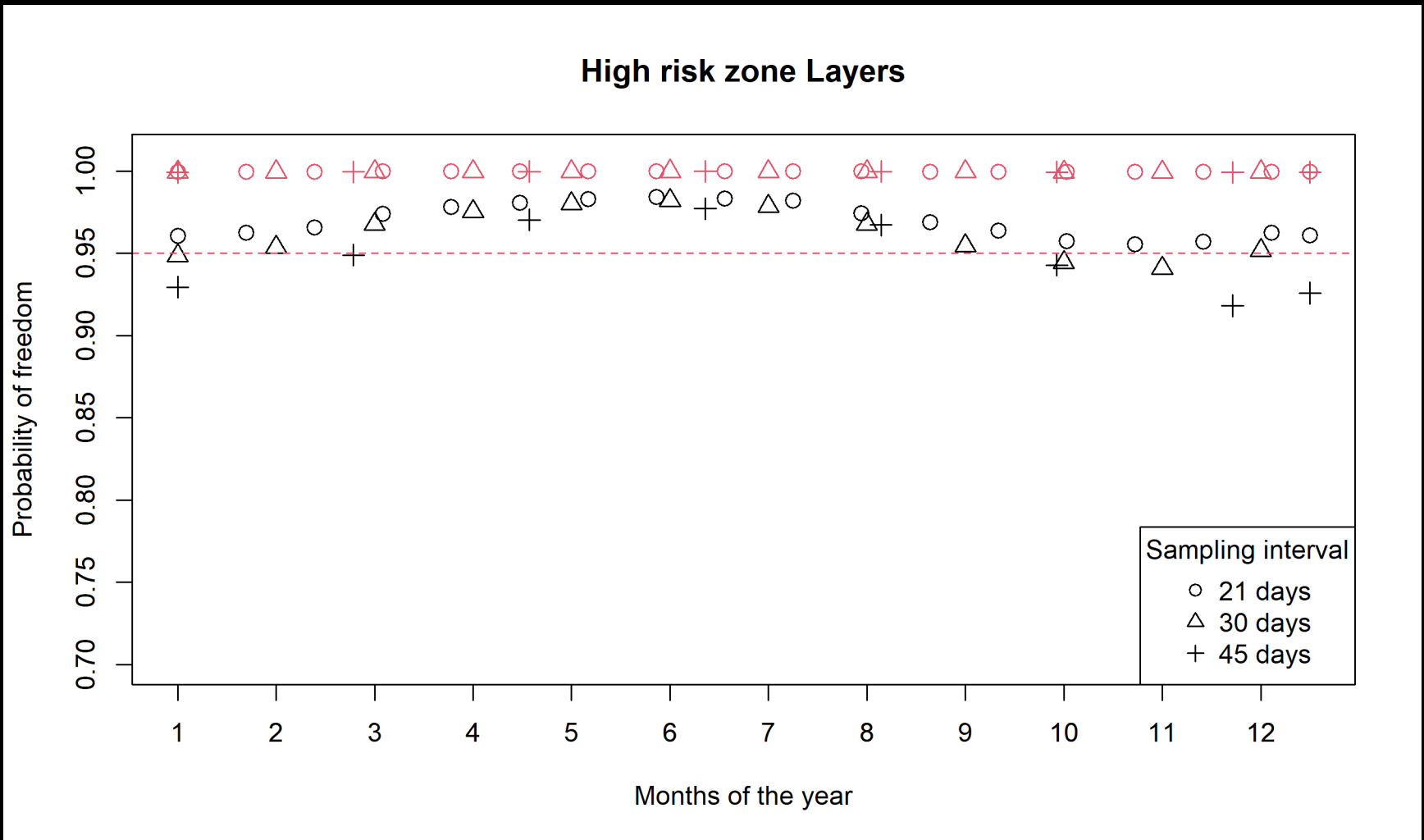
Simulation

When?



Temporal risk (monthly RR of intro) can be introduced as a risk node

Temporal discounting -> sampling frequency



The Netherlands: monthly probability of introduction between 2020-2023

Summary

The **sensitivity (efficacy)** and design approach of surveillance depends on:

The vaccination scenario (emergency or preventive vaccination) and the corresponding **surveillance output**

Emergency vaccination

Sample size and sampling frequency required for detection of an infected flock/farm before it transmits the infection on average to one or more farms **$R_h < 1$**

Preventive vaccination

Sample size and sampling frequency determined by the targeted level (>95%) of **confidence in freedom**

THANK YOU

